

- Pentagonella* Thor, 1936. Womersley & Heaslip, 1943; EWING, 1946a; Thor & Willmann, 1947; Lawrence, 1949; BRENNAN & WHARTON, 1950; WHARTON *et al.*, 1951.
- Eutrombicula* EWING, 1938, 1942, 1943, 1944a, 1946a. Radford, 1942; Womersley & Heaslip, 1943; MICHENNER, 1946a, 1946c; Philip & Woodward, 1946b; Thor & Willmann, 1947; Fuller, 1947b; WHARTON, 1947b; Womersley & Kohls, 1947; Lawrence, Jenkins, 1949; BRENNAN & WHARTON, 1950; WHARTON *et al.*, 1951.
- Subgenus *Eutrombicula* Thor & Willmann, 1947. Fuller, 1948; Jenkins, 1949; WHARTON *et al.*, 1951.
- Fonsecia* Radford, 1942, 1946c. Womersley & Heaslip, 1943; Ewing, 1944a, 1944b; Sayers *et al.*, 1947; Lawrence, 1949.
- Fonsecia* Radford, 1946. WHARTON *et al.*, 1951.
- Subgenus *Fonsecia* WHARTON *et al.*, 1951.
- Acariscus* EWING, 1943, 1944a. WOMERSLEY, 1944; WHARTON, 1945b, 1947b; MICHENNER, 1946a, 1946c; Philip & Woodward, 1946b; Lawrence, 1949.
- Crotiscus* Ewing, 1944a. Lawrence, 1949; WHARTON *et al.*, 1951.
- Megatrombicula* MICHENNER, 1946b, 1946d. Lawrence, 1949; BRENNAN & WHARTON, 1950; WHARTON *et al.*, 1951.
- Trombiculindus* Radford, 1948. WHARTON *et al.*, 1951.
- Subgenus *Trombiculindus* WHARTON *et al.*, 1951.
- Leptotrombicula* Manson-Bahr, 1948.
- (non) *Leptus* Latreille, 1804. Miyajima & Okumura, 1917b; Nagayo *et al.*, 1917b; Miyajima, 1917; Okumura, 1918; Kitashima & Miyajima, 1918b; Tanaka, 1918, 1919; Kawamura, 1926; Warburton, 1928; Kaiwa *et al.*, 1929; Gater, 1932; Blake *et al.*, 1945a; PHILIP, 1947b.
- (non) *Trombicula* Berlese, 1905. André, 1929.

#### PART V.

##### TROMBICULA MINOR, T. MEDIOCRISS, & T. HIRSTI.

The type and paratype of *T. minor* Berlese, 1905, have been destroyed, and the procuring of a neotype is likely to be difficult. The site where a topotype must be searched for is not only very limited in extent but is also difficult of access (certain caves at Tjompea in Java); moreover, the available data on which to base a neotype are not very comprehensive or detailed. All this is dealt with in my paper: "On *Trombicula minor* Berlese, 1905" (1951).

In 1939 I bred the nymph of *T. hirsti* var. *buloloensis* (*mihi*), and Womersley identified it with *T. minor* and with *T. hirsti* Sambon, 1927. I concurred in this, and in 1940 worked out the logical synonymy of *T. minor* based on these premises. Then in the Pacific War years, when the vectors of mite typhus were subjected to widespread intensive research, there arose two schools of thought, one accepting that *T. minor* and *T. hirsti* were synonymous, the other remaining unconvinced. In 1950 I consulted Herr Carl Willmann (the only living man who has seen and studied the genotype), and he confirmed that *T. hirsti* was not *T. minor*. But meanwhile both views had been widely adopted in the literature, and it is safe to assume that since 1942 any mention of "*T. minor*", unless specifically designated as referring to the genotype, should be read as "*T. hirsti*".

But that is not all—from 1946 on, there has been an increasing number of opinions that *T. hirsti* is synonymous with *T. wichmanni* (Oudemans, 1905). I cannot concede their complete identity, and am convinced that they are divisible at least into distinct subgenera. This will be discussed in Part VI; meanwhile I am listing them as distinct species.

##### TROMBICULA MINOR Berlese, 1905.

- BERLESE, A., 1905. *Redia*, ii, ii, 155.
- Trombicula minor* Berlese, 1905, 1912. EWING, 1920, 1938, 1942, 1944; WILLMANN, 1941; Womersley, 1944; Thor & Willmann, 1947; PHILIP, 1947b; Jenkins, 1949; GUNTHER, WHARTON *et al.*, 1951.

*Trombicula minor* Brumpt, 1949.

*Trombicula minor* Berlese, 1904. Gunther, 1939b, 1940c; Womersley, 1939.

(non) *Trombicula minor* Berlese, 1904 (= *T. hirsti* Samson, 1927). Heaslip, 1941; Womersley & Heaslip, 1943; Finnegan, 1945.

(non) *Trombicula minor* Berlese, 1905 (= *T. hirsti* Samson, 1927). Gunther, 1939a, 1940a, 1940c, 1940d, 1941c, 1942; Womersley, 1939, 1944; Manson-Bahr, 1940; Ewing, 1942, 1944b; Ahlm & Lipschutz, Williams, Cook, 1944; McCulloch, 1944, 1946, 1947; Blake et al., 1945a; Fischbach & Howell, 1945; Dumbleton, Fenner, H.M. Stat. Off., 1946; Philip & Woodward, 1946b; Fuller, 1947b; Philip & Kohls, Kohls, 1948; Philip & Traub, 1950.

(non) *Trombicula wachmanni* (Oudemans, 1905). McCulloch, 1946; Fuller, 1947b; Philip & Kohls, Kohls, 1948; Audy & Harrison, 1950.

(non) *Trombicula mediocris* Berlese, 1912. GUNTHER, 1940c, 1941c; Womersley & Heaslip, 1943.

(non) *Trombicula pseudoakamushi* Hatori, 1919 (= *T. hirsti* Samson, 1927, nec *T. pseudoakamushi* Kaiwa et al., 1929, non Tanaka et al., 1930, non 1916). Gunther, 1940c, 1941c; Fuller, 1947b.

(non) *Trombicula pseudoakamushi* (*variatio deliensis*) Walch, 1924a. Gunther, 1940c, 1941c; Womersley & Heaslip, 1943; Womersley, 1944.

(non) *Trombicula pseudoakamushi* (*variatio deliensis* ?) Walch, 1925. Gunther, 1940c.

(non) *Trombicula hirsti* Samson, 1927. Womersley, 1939; Gunther, 1940c; Heaslip, 1941; Ewing, 1942, 1944c; Womersley & Heaslip, 1943; Womersley, 1944; Dumbleton, 1946.

(non) *Trombicula hirsti* var. *morobensis* Gunther, 1938. Gunther, 1939b, 1940c; Womersley & Heaslip, 1943; Womersley, 1944.

(non) *Trombicula hirsti* var. *buloloensis* Gunther, 1939a, 1939b, 1940a, 1940c, 1940d, 1942. Womersley, 1939, 1944; Ewing, Radford, 1942; Womersley & Heaslip, 1943; Blake et al., 1945a.

(non) *Trombicula buloloensis* (Gunther, 1939) Blake et al., 1945a. Philip & Woodward, 1946b; Fuller, 1947b; Kohls, Philip & Kohls, 1948.

(non) *Trombicula minor* var. *deliensis* (Walch, 1923) Womersley & Heaslip, 1943. Womersley, 1944; Dumbleton, 1946.

(non) *Trombicula hectorii* Womersley & Heaslip, 1943.

(non) *Schongastia minor* (? = *T. hirsti* Samson, 1927) U.S. War Dept., 1944.

(non) *Neoschongastia minor* (? = *T. hirsti* Samson, 1927) Bull. U.S. Army Med. Dept., 1944.

(non) *Trombicula minor* (Willmann, 1941) (? = *T. hirsti* Samson, 1927), No. 2 E.F.U. 1945.

Type and Paratype, Adults: Formerly at Hamburg Museum, but destroyed, 1943 (Gunther, 1951).

Java: ? bats (original specimens sifted from guano in cave at Tjompea).

#### TROMBICULA MEDIOCRAST Berlese, 1912.

BERLESE, A., 1912. *Redia*, viii, i, 1.

*Trombicula mediocris* BERLESE, 1912. Miyajima, 1917; Hatori, 1920; Kawamura et al., 1921; Walch, 1923; Gater, 1932; GUNTHER, 1940c, 1941c, 1951; Womersley & Heaslip, 1943; Thor & Willmann, 1947.

*Trombicula mediocris* (J. de Vidas, 1945) Brumpt, 1949.

(non) *Trombicula minor* Berlese, 1905 (= *T. hirsti* Samson, 1927). Gunther, 1940c, 1941c; Womersley & Heaslip, 1943.

(non) *Trombicula pseudoakamushi* Hatori, 1919. Miyajima, 1917.

Type: Adult.

Java: Taken free at Buitenzorg.

## TROMBICULA HIRSTI Sambon, 1927.

- SAMBON, L. W., 1927: *Ann. Mag. Nat. Hist.*, ix, xx, 157.  
*Trombicula hirsti* SAMBON, 1927 (nec *T. hirsti* Hirst, 1929). Ewing, 1928, 1942; Patton & Evans, 1929; Gater, Matheson, 1932; WOMERSLEY, 1939, 1944; GUNTHER, 1939a, 1940a, 1940c, 1940d, 1942, 1951; Heaslip, 1941; Radford, 1942; Womersley & Heaslip, 1943; Farmer & Katsampes, Williams, Cilento, 1944; Hayakawa Tanaka *et al.*, Hayakawa & Muro, Finnegan, No. 2 E.F.U., 1945; Dumbleton, Roy, 1946; PHILIP & WOODWARD, 1946b; Thor & Willmann, Hayakawa & Hokari, 1947; Chandler, 1949.  
*Thrombicula hirsti* Brumpt, 1949.  
*Trombicula hirsti* (Gater, 1932) Blake *et al.*, 1945a.  
*Eutrombicula hirsti* Philip & Woodward, 1946b.  
*Trombicula minor* Berlese, 1904. Gunther, 1939b, 1940c; Womersley, 1939; Heaslip, 1941; Womersley & Heaslip, 1943; Finnegan, 1945.  
*Trombicula minor* Berlese, 1905. Gunther, 1940a, 1940d, 1941c, 1942; Manson-Bahr, 1940; Ewing, 1942, 1944b; Ahlm & Lipshutz, Womersley, Williams, Cook, 1944; McCulloch, 1944, 1946, 1947; Blake *et al.*, 1945a; Fischbach & Howell, 1945; Dumbleton, Fenner, H.M. Stat. Off., 1946; Philip & Woodward, 1946b; Fuller, 1947b; PHILIP & KOHLS, Kohls, 1948; Philip & Traub, 1950.  
*Trombicula minor* (Willmann, 1941) No. 2 E.F.U., 1945.  
(?) *Schongastia minor* U.S. War Dept., 1944.  
(?) *Neoschongastia minor* Bull. U.S. Army Med. Dept., 1944.  
*Trombicula hirsti* var. *moroensis* Gunther, 1938, 1939a, 1939b, 1940c, 1951 (*nom. nud.*). Womersley & Heaslip, 1943; Womersley, Farmer & Katsampes, 1944.  
*Trombicula hirsti* var. *buloloensis* GUNTHER, 1939a, 1939b, 1940c, 1940d, 1942, 1951. Womersley, 1939, 1944; Ewing, 1942, 1944c; Womersley & Heaslip, 1943; Radford, 1946b.  
*Trombicula hirsti* var. *boloensis* Farmer & Katsampes, 1944 (*laps. cal.*).  
*Trombicula buloloensis* (Gunther, 1939) Blake *et al.*, 1945a. Kohls *et al.*, 1945; McCulloch, 1946; Bushland, 1946a, 1946b; Philip & Woodward, 1946b; Griffiths, 1947; Fuller, 1947b; Kohls, Philip & Kohls, 1948.  
*Trombidium buloloensis* Blake *et al.*, 1945c.  
*Eutrombicula buloloensis* (Gunther, 1939) Wharton, 1946a.  
(non) *Trombicula hirsti* Sambon, 1927 (= *T. hirsti* Hirst, 1929 = *T. samboni* Womersley, 1939). Hirst, 1929a, 1929c, 1929d; Womersley, 1934, 1936, 1937.  
(non) *Trombicula minor* Berlese, 1905. Gunther, 1940c.  
(non) *Trombicula wichmanni* (Oudemans, 1905). McCulloch, 1946; Fuller, 1947b; Philip & Kohls, Kohls, 1948; Audy & Harrison, 1950 (= *T. minor* Berlese, 1905 [= *T. hirsti* Sambo, 1927]); McCulloch, 1946; Griffiths, 1947 (= *T. buloloensis* Gunther, 1939); McCulloch, 1946 (= *T. minor* var. *deliensis* Walch, 1923). Scrub-itch mite (Australia: Jackson, 1908); *tungau* (Malaya: Patton & Evans, 1929); *bush-mokka*, *pipi*, *gugung* (New Guinea: Gunther, 1939a); *sanana*, *tigali*, *dedigalogata* (Papua: Gunther, 1939a).  
Types, Larva: British Museum. Nymph: S. Aust. Museum.  
Paratype, Nymph: School Pub. Health Trop. Med., Univ. Sydney.  
Hypotypes, Larvae: Brit. Mus.; S.P.H.T.M., Univ. Sydney; Aust. Mus.; S. Aust. Mus.; Natal Mus.; Rocky Mountain Lab.; Univ. Calif.; Liverpool School Trop. Med.; Tulane Univ.; P.H.D., Brisbane; Hosp. Generale, Mexico City; coll. van Eyndhoven; coll. Rosas Costa.  
Queensland, Malaya, New Guinea: Man.  
Queensland: Possum (*Trichosurus johnstoni*), bandicoots (*Perameles nasuta*, *Isoodon obesulus*, *I. torosus*), free on boots.  
Malaya: Rats (*R. jalorensis*, *R. diardi*), shrew (*Tupaia ferruginea*), *Gallus gallus*. New Guinea: Pig (*Sus papuensis*), wallaby, rat (*R. gestri*), bandicoot (*Echymipera cockerelli*), ground birds (*Megapodius reinwardt*, *Talegalla jobiensis*, *Gallicolumba jobiensis*, *Casuarius casuarius*), swamp birds (*Amaurornis nigrifrons*, *Porphyrio melanotus*), catbird (*Ailuroedus melanocephalus*), pitta (*P. mackloti*), free on boots.  
Celebes: Rat.

## PART VI.

## TROMBICULA WICHMANNI &amp; T. HAKEI.

The following authorities have given, in effect, their opinion that *T. hirsti* Sampon, 1927, is synonymous with *T. wichmanni* (Oudemans, 1905), in that they have affirmed the identity of *T. wichmanni* with various synonyms of *T. hirsti*:

FULLER, 1947b; KOHLS, 1948; PHILIP & KOHLS, 1948; AUDY & HARRISON, 1950: *T. wichmanni* = *T. minor* (= *T. hirsti*).

MCCULLOCH, 1946: *T. wichmanni* = *T. minor* var. *deliensis* (= *T. hirsti*).

MCCULLOCH, 1946; GRIFFITHS, 1947: *T. wichmanni* = *T. buloloensis* (= *T. hirsti*).

It must be pointed out, however, that all of these opinions were given before the practical possibilities of developing suitable subgenera of the Trombiculidae had been fully examined. I am reasonably familiar with both *T. wichmanni* and *T. hirsti*, and I am not convinced that there is no definable demarcation, at least at subgeneric level, between them; at any rate, I am listing them here as distinct species.

*T. hakei* is included in this Part because it has been suggested that it is synonymous with *T. wichmanni*.

## TROMBICULA WICHMANNI (Oudemans, 1905) Hirst, 1917.

OUDEMANS, A. C., 1905: *Ent. Ber. Ned. Ent. Ver.*, i, xxii, 216; HIRST, S., 1917: *Brit. Mus. (Nat. Hist.) Econ. Ser.*, vi.

*Thrombidium wichmanni* Oudemans, 1905, 1906, 1909 (*nom. gen. praeocc.*). Fantham et al., 1916; Matheson, 1932; Gunther, 1941c.

*Allotrombidium wichmanni* Oudemans, 1906. Womersley & Heaslip, 1943.

*Trombidium (Heterotrombidium) wichmanni* Verdun, 1909. Womersley & Heaslip, 1943.

*Microtrombidium wichmanni* Oudemans, 1912a. Ewing & Hartzell, 1918; Warburton, 1928; Manson-Bahr, 1929; Gunther, 1941c; Womersley & Heaslip, 1943; Brumpt, 1949.

*Trombicula wichmanni* HIRST, 1917. Oudemans, 1912b, 1913, 1916; Walch, 1923, 1924a; Sampon, 1927; Patton & Evans, 1929; Gater, 1930; Gunther, 1939a, 1940a, 1940b, 1940d, 1941c, 1942, 1951; Womersley, 1939, 1944; Radford, 1942; Womersley & Heaslip, 1943; Finnegan, 1945; Philip et al., McCulloch, 1946; Philip & Woodward, 1946b; Ewing, 1946a; Thor & Willmann, Griffiths, 1947; Philip & Kohls, Kohls, 1948; Chandler, 1949; Audy & Harrison, 1950; Wharton et al., 1951.

*Eutrombicula wichmanni* Ewing, 1938. Sayers et al., 1945; Philip & Woodward, 1946b; Fuller, 1947b; Philip, 1947b; Philip & Fuller, 1950.

(non) *Trombicula minor* (= *T. hirsti* Sampon, 1927). Fuller, 1947b; Philip & Kohls, Kohls, 1948; Audy & Harrison, 1950.

(non) *Trombicula buloloensis* (Gunther, 1939): McCulloch, 1946; Griffiths, 1947.

(non) *Trombicula hatorii* Womersley & Heaslip, 1943: Philip, 1947b; Philip & Fuller, 1950.

(non) *Trombicula minor* var. *deliensis*: McCulloch, 1946.

*Gonone* (Celebes: Oudemans, 1906).

Type, *Larva*.

Hypotypes, *Larvae*: School Pub. Health Trop. Med., Univ. Sydney; British Museum; Aust. Mus.; S. Aust. Mus.

Celebes, Philippine Is.: Man.

British North Borneo: Mouse deer (*Tragulus borneanus*).

Philippine Is.: Rats (*R. mindanensis*, *R. calcis*).

Dutch New Guinea: Goura pigeon (*Goura scheepmakeri*).

Brunei, Balikpapan, Morotai, New Guinea: Free.

## TROMBICULA HAKEI Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc. Lond.*, exvi, ii, 247.

*Trombicula hakei* Radford, 1946c.

(non) *Trombicula wichmanni* (Oudemans, 1905). Fuller, fide Sayers et al., 1947.

Type, *Larva*: British Museum.

Imphal (India): Snake (*Coluber radiatus*), cobra (*Naia fasciatus*).

## PART VII.

## THE JAPANESE &amp; FORMOSAN TROMBICULAE, &amp; T. OBSCURA.

That nearly all of the very important work by the Japanese is in their own language, and is therefore quite inaccessible to occidental workers, has led to many misconceptions. When Dr. C. B. Philip of the Rocky Mountain Laboratory had the various Japanese papers translated, he made many surprising discoveries (Philip, 1947b). I am deeply indebted to him for giving me access to these translations.

In the first place, it is obvious that papers on mite systematics did not reach Japan until 1915, and did not reach the majority of workers until 1917. Previous to then, the Japanese called the vector of mite typhus (and sometimes some of its allies) "the akamushi" (= red mite); various other species came to be called "the pseudoakamushi"—the Tanaka school applied this name to those species more closely allied to akamushi, whereas Hatori applied it to the Japanese harvest mite.<sup>1</sup>

Nagayo and his varying associates were the leaders in adopting conventional nomenclature (Nagayo *et al.*, 1915e: "*Trombidium* and the Akamushi"). Then, in 1917, they devised *Leptotrombidium* because *Trombidium* Berlese, 1888, used by Brumpt for *T. akamushi*, was preoccupied by *Trombidium* Fabricius, 1775—hence also *Microtrombidium akamushi* Hirst, 1915a and *Leptus akamushi* Miyajima & Okumura, 1917b; but as soon as they had the opportunity of comparing their nymphs and adults with Berlese's *Trombicula minor*, it became obvious that *Trombicula* had priority, and so in Nagayo *et al.*, 1918, we find *Trombicula akamushi*, and in 1919, *T. akamushi akamushi*, *T. akamushi nov. var. pallida*, and *T. palpalis nov. sp.*; in 1920 they added *T. intermedia* (1920b) and *T. scutellaris* (1920c).

Meanwhile, in 1917, Miyajima identified the pseudoakamushi (= harvest mite) first as *Leptus autumnalis* and later as *Trombicula mediocoris* (both refuted by Hatori in 1920); Kishida stated that in 1909 he had used "Kedania tanakai" for *Thrombidium akamushi* Brumpt, 1910; Nagayo *et al.* introduced "the tsutsugamushi" as a substitute for the akamushi, which had acquired a more special application; and Miyajima & Okumura classified the akamushi into "thin-haired" and "coarse-haired" types (to which Kawamura *et al.* later added an "intermediate" type).

Kawamura *et al.* in 1920 made another classification of the akamushi and its allies, into Types A, B, C, and D (and later, Type E, in Kawamura, 1926). Meanwhile, in 1918, Tanaka gave a definite description of the pseudoakamushi (= one of the allies of the akamushi, not the harvest mite).

It is an important point that no mention of *Trombicula pseudoakamushi* as such is to be found until Hatori, 1919, or of *Trombicula autumnalis japonica* until Kaiwa *et al.*, 1929; until these dates, the names used by all writers (including Tanaka) were "the pseudoakamushi" and "the Japanese *Trombicula autumnalis*".

In 1921 Nagayo *et al.* correlated the 1917–1920 work, and gave their list of "the kinds of the tsutsugamushi":

*Trombicula akamushi*: Type A, thin-haired.

*T. pallida*: Type D, coarse-haired, equivalent to Tanaka's pseudoakamushi.

*T. palpalis*: Type C.

*T. intermedia*.

*T. scutellaris*: Type B.

In 1929 Kaiwa *et al.* described "*T. pseudoakamushi* A and B" (not the harvest mite), and stated that "A" was equivalent to *T. pallida* and "B" to *T. palparis* (*sic*); they also stated that *T. akamushi* was equivalent to "Kedania tanakai" Kishida, 1909, and that *T. autumnalis japonica* was *Leptus autumnalis japonica*. Tanaka *et al.*, 1930, use these same names, but claim that Tanaka used *T. pseudoakamushi* in 1916.

As for the pseudoakamushi (= harvest mite), Hatori described it under the name *Trombicula pseudoakamushi* in 1919, but claimed (1920) that he had used that name in 1917.

From all of this there emerge three problematical names: *Kedania tanakai* Kishida, 1909; *T. pseudoakamushi* Tanaka, 1916; and *T. pseudoakamushi* Hatori, 1917. Nobody has so far been able to locate the publications in which these names, actually so written,

at the dates claimed for them, are alleged to have appeared. As far as actual records go, the name *Kedania tanakai* appears to have been first used by Kishida in 1917, and so it must at the present time be regarded as a synonym of *T. akamushi* (Brumpt, 1910). Similarly, there exists no evidence that *Trombicula pseudoakamushi* was used before Hatori in 1919 (for the Japanese harvest mite); certainly in none of Tanaka's available papers does he use the name until 1930, while it was previously used by Kaiwa *et al.* in 1929—they stated that it was equal to *T. pallida* (Nagayo *et al.*, 1919). Consequently we can no longer accept *T. pseudoakamushi* Tanaka, 1916, as the prior name, with *T. pallida* as a synonym—*T. pallida* has precedence, and *T. pseudoakamushi* of Tanaka and of Kaiwa *et al.* becomes a synonym of *T. pallida*.

This leaves *T. pseudoakamushi* Hatori, 1919, with precedence—it had drifted uncertainly about in limbo for years until Womersley & Heaslip rescued it in 1943 and labelled it *T. hatorii*. There is no record to be found of Hatori's having used this actual name in 1917, and we must accept its date as 1919. Still, there is another difficulty about this species: there is a lot of indirect evidence that *T. hirsti* Sampon, 1927, and *T. pseudoakamushi* are identical. Theoretically this is almost certainly so—but I am not aware that anybody has as yet compared actual specimens. If it were so, then *T. pseudoakamushi* would take precedence; but I am listing them separately here until further studies have been made.

Another point about the Japanese mites is that Ewing (1925) stated that probably *T. pallida*, *T. palpalis*, *T. intermedia*, and *T. scutellaris* were only seasonal variations of *T. akamushi*. In 1940 my teacher and very good friend, the late Frank H. Taylor, to whom I was indebted for much valuable help and advice, collected all the authenticated specimens in Australia and sent them to me for examination; in my opinion these are all valid and distinct species.

I have grouped the Japanese and Formosan Trombiculæ together in this Part for convenience, and have added *T. obscura* Womersley, 1944, since it seems almost certainly doomed to become a synonym of *T. akamushi*.

#### TROMBICULA AKAMUSHI (Brumpt, 1910) Hirst, 1917.

BRUMPT, E., 1910: Précis de Parasitologie, 2 Ed., Paris, 506; HIRST, S., 1917: Brit. Mus. (Nat. Hist.) Econ. Ser., vi.

*Thrombidium akamushi* Brumpt, 1910, 1949 (nom. gen. praeocc.). Fantham *et al.*, 1916; Kishida, 1917.

*Trombidium akamushi* Brumpt, 1910: Nagayo *et al.*, 1915e, 1915f, 1916b, 1917a; Miyajima & Okumura, 1917a, 1917b.

*Microtrombidium akamushi* Hirst, 1915a, 1915b. Miyajima & Okumura, 1917b; Warburton, 1928; Gater, 1932; Gunther, 1939b; Manson-Bahr, 1948.

*Kedania tanakai* Kishida, 1909 (?), 1917. Kawamura, 1926; Kaiwa *et al.*, 1929; Tanaka *et al.*, 1930; PHILIP, 1947b; PHILIP & KOHLS, 1948.

*Microtrombidium brumpti* Hirst, 1915a (laps. mem.). Ewing, 1920; Gater, 1932.

*Leptotrombidium akamushi* Nagayo *et al.*, 1917a. Kawamura, 1926; Gater, 1932; Ewing, 1942; PHILIP, 1947b.

*Leptotrombicula akamushi* Manson-Bahr, 1948.

*Leptus akamushi* Miyajima & Okumura, 1917b (nom. gen. praeocc.).

*Trombicula akamushi* Hirst, 1917, 1929a. Nagayo *et al.*, 1918, 1919, 1920a, 1920b, 1920c, 1921; Hayashi *et al.*, 1918; Hatori, 1919; Kawamura *et al.*, 1920a, 1920b, 1921; Kawamura & Yamaguchi, 1921; Walch, 1922a, 1923, 1924a; Walch & Keukenschrijver, 1924; Ewing, 1925, 1928, 1929, 1937, 1942, 1944a, 1944b, 1944c; KAWAMURA, 1926; Sampon, 1927; Fletcher *et al.*, Warburton, 1928; Fletcher & Field, Stitt, Patton & Evans, Kaiwa *et al.*, 1929; Manson-Bahr, 1929, 1940, 1948; Tanaka *et al.*, 1930; Lewthwaite, 1930, 1945a, 1945b; GATER, 1930, 1932; Patton, 1931; Matheson, Fonseca, 1932; Lewthwaite & Savoor, 1936a, 1936b, 1936c, 1936d, 1940; Chandler, 1936, 1949; Kawamura & Ikeda, 1936; Mühlens *et al.*, Sugimoto, Riley & Johanssen, 1938; Gunther, 1939a, 1940a, 1940d, 1942; Kawamura & Yamamiya, Herms, 1939; Heaslip, Poynton, 1941; Morishta, Culbertson, 1942; Radford, 1942, 1946a; Womersley &

Heaslip, 1943; Banerjea & Bhattacharya, 1943, 1945; Ahlm & Lipshutz, Farner & Katsampes, Williams, Nauss, Strong, Cook, Bercovitz, Logue, Bull. U.S. Army Med. Dept., Womersley, Cilento, Kouwenhaar & Wolff, 1944; U.S. War Dept., 1944, 1948; Rogers & Megaw, 1944, 1946; Fischbach & Howell, Craig & Faust, Tidy, Finnegan, No. 2 E.F.U., Megaw, Anderson & Wing, 1945; Mackie *et al.*, 1945, 1946; BLAKE *et al.*, 1945a, 1945c; Philip & Kohls, 1945, 1948; Philip & Tamiya, Farner, Wharton & Carver, Johnson & Wharton, H.M. Stat. Off., McCulloch, Roy, 1946; Philip *et al.*, 1946, 1949; Wharton, 1946a, 1946b, 1947b; Philip & Woodward, 1946b; Thor & Willmann, Sayers *et al.*, Griffiths, Audy, Mohr, Hayakawa & Hokari, Sadusk, 1947; PHILIP, 1947a, 1947b, 1948, 1949; Dubois & van den Berghe, Cockings, Smart, Kohls, 1948; Audy & Harrison, Traub & Frick, Jones, Traub *et al.*, Philip & Fuller, Pullen, 1950; WHARTON *et al.*, 1951.

*Trombicula akamushi akamushi* Nagayo *et al.*, 1919.

*Trombicula fletcheri* Womersley & Heaslip, 1943. Womersley, Cook, Ahlm & Lipshutz, 1944; McCulloch, 1944, 1946; Kohls *et al.*, Finnegan, Fischbach & Howell, 1945; PHILIP & KOHLS, 1945, 1948; Blake *et al.*, 1945a, 1945b, 1945c; PHILIP *et al.*, 1946; WHARTON, 1946a; PHILIP & WOODWARD, 1946b; Bushland, 1946a; Southcott, Sadusk, Irons *et al.*, GRIFFITHS, Sayers *et al.*, 1947; PHILIP, 1947b, 1948; KOHLS, 1948; Chandler, 1949; Audy & Harrison, Pullen, 1950.

*Thrombicula fletcheri* Womersley & Heaslip, 1945. Brumpt, 1949.

(?) *Trombicula obscura* Womersley, 1944. Sayers *et al.*, 1947; (?) Philip & Kohls, 1948.

(non) *Trombidium coarctatum* Berlese, 1888 (= *Trombicula coarctata* Berlese, 1912).

Kitashima & Miyajima, 1918b; Manson-Bahr, 1929; Gater, 1932; Heaslip, 1941.

(non) *Trombicula pallida* (Nagayo *et al.*, 1919). Ewing, 1925.

(non) *Trombicula palpalis* Nagayo *et al.*, 1919. Ewing, 1925.

(non) *Trombicula intermedia* Nagayo *et al.*, 1920b. Ewing, 1925.

(non) *Trombicula scutellaris* Nagayo *et al.*, 1920c. Ewing, 1925.

(non) *Trombicula pseudoakamushi* Kaiwa *et al.*, 1929 non Tanaka, 1916. Gater, 1932.

(non) *Trombicula deliensis* Waleh, 1922a. Gater, 1930, 1932; Heaslip, 1941; Philip & Woodward, 1946b; PHILIP & KOHLS, PHILIP, 1948.

*Akamushi* Baelz & Kawakani, 1879; *kedani* Tanaka, 1899; *pseudoakamushi*, *shimamushi*, *yochu* Tanaka, 1916; *tsutsugamushi* Nagayo *et al.*, 1917a; "thin-haired type" Miyajima & Okumura, 1917a; type A Kawamura *et al.*, 1920a.

Types: Adult, nymph, & larva: Kitasato Research Institute.

Paratypes & Hypotypes, Adult: Brit. Mus., S.P.H.T.M., Univ. Syd.—Nymph: U.S. Nat. Mus.—Larva: Brit. Mus., S.P.H.T.M., Univ. Syd., U.S. Nat. Mus., Molteno Inst., Rocky Mountain Lab.

Japan, Malaya: Man.

Japan, Formosa: Dog, buffalo, mouse (*Mus musculus*), field mouse (*Apodemus agrarius*), rats (*R. rattus*, *R. norvegicus*, *R. rufescens*), pheasant (*Phasianus formosanus*), *Gallus gallus*, quail (*Turnix taigoor*).

Japan: Rats (*R. alexandrinus*, *R. manipulus*, *Arvicola hatanedzumi*), mice (*Mus speciosus*, *M. jerdoni*), vole (*Microtus montebelloi*), cat, horse, warbler (*Acrocephalus orientalis*).

Formosa: Ox, *Rattus losea*, mice (*Mus formosanus*, *Apodemus ningpoensis*), shrews (*Crocidura murina*, *Suncus swinhonis*), pheasant (*Centrococcyx javanicus*).

Malaya: Rats (*R. diardi*, *R. jalorensis*, *R. argentifer*, *R. whiteheadi*, *R. browni*, *Trichys fasciculata*).

Burma: Rats (*R. rattus*, *R. sladensis*, *R. yunnanensis*).

Maldives Is.: *R. alexandrinus*.

Ceylon: *R. kandianus*.

Nepal: *R. fulvescens*.

China: *R. bowersi*.

Philippines Is.: Rats (*R. umbriventer*, *R. mindanensis*).

Pescadores Is.: *R. norvegicus*, *R. rufescens*, birds.

New Guinea: Rats (*R. browni*, *R. mordax*, *R. praetor*, *R. gestri*), bandicoot (*Echymipera cockerelli*).

## TROMBICULA PSEUDOAKAMUSHI Hatori, 1919.

- HATORI, J., 1919: *Ann. Trop. Med. Parasit.*, xlii, 233.  
*Trombicula pseudoakamushi* Hatori, 1917 (?) *fide* Hatori, 1919.  
*Trombicula pseudoakamushi* Hatori, 1919 (*non T. pseudoakamushi* Tanaka, 1916 (?))  
*nec* Kaiwa *et al.*, 1929 *nec* Tanaka *et al.*, 1930). Hatori, 1920; Kawamura *et al.*,  
1921; Walch, 1923, 1924a, 1925, 1927; Walch & Keukenschrijver, 1924; KAWAMURA,  
1926; Fletcher *et al.*, 1928; Hirst, 1929a; Patton & Evans, 1929; Gater, 1932;  
GUNTHER, 1939a, 1940a, 1940c, 1941c, 1951; Radford, 1942, 1946b; Womersley &  
Heaslip, 1943; Blake *et al.*, 1945a; Hayakawa & Muro, Hayakawa, Tanaka *et al.*,  
1945; Fuller, 1947b; PHILIP, 1947b; Hayakawa & Hokari, 1947.  
*Trombicula pseudoakamushi* Hatori, 1918. Gunther, 1940a.  
*Trombicula pseudoakamushi* (*variatio deliensis*) Walch, 1924a. GUNTHER, 1940c, 1941c,  
1951; Blake *et al.*, 1945a.  
*Trombicula pseudoakamushi* (*variatio delicensis* ?) Walch, 1925. GUNTHER, 1940c, 1951;  
Finnegan, 1945.  
*Trombicula pseudoakamushi* var. *deliensis* Walch, 1923. Womersley & Heaslip, 1943;  
Womersley, 1944; Dumbleton, McCulloch, 1946.  
*Trombicula hatorii* Womersley & Heaslip, 1943. Womersley, 1944; Finnegan, 1945;  
McCULLOCH, 1946; PHILIP & WOODWARD, 1946b; PHILIP, 1947b.  
(*non*) *Trombidium holosericeum* Linné. Nagayo *et al.*, 1917b.  
(*non*) *Trombicula mediocris* Berlese, 1912. Miyajima, 1917 (?), *fide* Hatori, 1920;  
Kawamura & Yamaguchi, 1921.  
(*non*) *Leptus autumnalis* (Shaw, 1790). Miyajima, 1917; Tanaka, 1918; Hatori, 1920.  
(*non*) *Trombicula wiechmanni* (Oudemans, 1905). PHILIP, 1947b.  
Patau (Formosa: Patton & Evans, 1929).  
Type, *Larva*.  
Formosa: Rat (*R. rufescens*), pheasant (*Centrococcyx javanicus*).  
Sumatra: Gibbon (*Hylobates agilis*), pig, cat, goat, quail (*Excalfactoria chinensis*),  
pheasant (*C. javanicus*), *Gallus gallus*.
- TROMBICULA PALLIDA (Nagayo *et al.*, 1919) Nagayo *et al.*, 1920.
- NAGAYO, M., MIYAGAWA, Y., MITAMURA, T., & TAMIYA, T., 1919: *Verhandl. der jap.  
pathol. Gesellschaft. Tokyo*, ix, 107; NAGAYO, M., MITAMURA, T., & TAMIYA, T., 1920:  
*Jikken Igaku Zasshi*, iii, iv, 265.
- Trombicula akamushi* nov. var. *pallida* NAGAYO *et al.*, 1919.
- Trombicula pallida* Nagayo *et al.*, 1920a, 1920b, 1920c, 1921, Walch, 1922a, 1924a; Ewing,  
1925; Kawamura, 1926; Kaiwa *et al.*, 1929; Tanaka *et al.*, 1930; Radford, 1942, 1946a,  
1946b; Womersley & Heaslip, 1943; Blake *et al.*, 1945a; Finnegan, No. 2 E.F.U.,  
1945; Wharton, 1946a; Philip & Tamiya, 1946; PHILIP, 1947a, 1947b; Sayers *et al.*,  
1947; Kohls, 1948; Kuwata *et al.*, Philip & Fuller, Traub *et al.*, 1950.
- Trombicula pallida* Nagayo *et al.*, 1927. Sayers *et al.*, 1947.
- Thrombicula pallida* Brumpt, 1949.
- Trombicula pseudoakamushi* Kaiwa *et al.*, 1929 (= Tanaka, 1916 (?)) *fide* Tanaka *et al.*,  
1930). Kawamura, 1926; Fletcher & Field, 1929; Gater, 1932; Lewthwaite & Savoor,  
1936c; Gunther, 1940a, 1940c; Womersley & Heaslip, 1943; Takekawa, 1948; Philip  
& Fuller, 1950.
- (*non*) *Trombicula pseudoakamushi* Hatori, 1917 (?), 1919, 1920 (= *T. hatorii* Womersley  
& Heaslip, 1943 = *T. hirsti* Sambon, 1927).
- (*non*) *Trombicula akamushi* (Brumpt, 1910) Hirst, 1917. Ewing, 1925; Gater, 1932.
- (*non*) *Trombicula palpalis* Nagayo *et al.*, 1919. Ewing, 1925.
- (*non*) *Trombicula intermedia* Nagayo *et al.*, 1920b. Ewing, 1925.
- (*non*) *Trombicula scutellaris* Nagayo *et al.*, 1920c. Ewing, 1925.
- (*non*) *Trombicula palparis* Kaiwa *et al.*, 1929. Gater, 1932.
- Yasodani Tanaka, 1916; nezumidani Tanaka, 1919; "coarse-haired type" Miyajima &  
Okumura, 1917a; type D Kawamura *et al.*, 1920a; pseudoakamushi of Tanaka  
(Nagayo *et al.*, 1921); *T. pseudoakamushi* A Kaiwa *et al.*, 1929.

Type, *Nymph (?) & Larva*: Kitasato Research Institute.

Paratypes, *Larva*: Brit. Mus., S.P.H.T.M., Univ. Syd.

Japan: Vole (*Microtus montebelloi*), field mouse (*Apodemus speciosus*).

**TROMBICULA PALPALIS Nagayo et al., 1919.**

NAGAYO, M., MIYAGAWA, Y., MITAMURA, T., & TAMIYA T., 1919: *Verhandl. der jap. pathol. Gesellschaft. Tokyo*, ix, 107.

*Trombicula palpalis* Nagayo et al., 1919, 1920a, 1920b, 1920c, 1921. Walch, 1922a, 1924a; Ewing, 1925; Kawamura, 1926; Patton & Evans, 1929; Radford, 1942, 1946a, 1946b; Womersley & Heaslip, 1943; Blake et al., 1945a; Finnegan, 1945; Wharton, 1946a; Philip & Tamiya, 1946; Sayers et al., Thor & Willmann, 1947; Philip, 1947a, 1947b; Philip & Kohls, 1948; Kuwata et al., Philip & Fuller, 1950.

*Trombicula palparis* Kaiwa et al., 1929 (*Iaps. ling.*). Tanaka et al., 1930; Gater, 1932.

*Thrombicula palpatis* Brumpt, 1949.

(non) *Trombicula akamushi* (Brumpt, 1910). Ewing, 1925.

(non) *Trombicula pallida* (Nagayo et al., 1919). Ewing, 1925.

(non) *Trombicula intermedia* Nagayo et al., 1920b. Ewing, 1925.

(non) *Trombicula scutellaris* Nagayo et al., 1920c. Ewing, 1925.

Type C Kawamura et al., 1920a; intermediate type Kawamura, 1926; *T. pseudoakamushi* B Kaiwa et al., 1929.

Type, *Nymph (?) & larva*: Kitasato Research Institute.

Paratypes, *Larvae*: British Mus., S.P.H.T.M., Univ. Syd.

Japan: *Apodemus speciosus*, rodents and birds.

**TROMBICULA INTERMEDIA Nagayo et al., 1920.**

NAGAYO, M., MITAMURA, T., & TAMIYA, T., 1920: *Verhandl. der jap. pathol. Gesellschaft. Tokyo*, ix, 143.

*Trombicula intermedia* Nagayo et al., 1920b, 1920c, 1921. Walch, 1922a, 1924a; Ewing, 1925; Kawamura, 1926; Radford, 1942, 1946b; Womersley & Heaslip, 1943; Finnegan, 1945; Blake et al., 1945a; Wharton, 1946a; Philip & Tamiya, 1946; Philip, 1947a, 1947b; Sayers et al., 1947; Kohls, 1948; Kuwata et al., Philip & Fuller, 1950.

*Trombicula intermedia* Nagayo et al., 1927. Sayers et al., 1947.

*Thrombicula intermedia* Brumpt, 1949.

(non) *Trombicula akamushi* (Brumpt, 1910). Ewing, 1925.

(non) *Trombicula pallida* (Nagayo et al., 1919). Ewing, 1925.

(non) *Trombicula palpalis* Nagayo et al., 1919. Ewing, 1925.

(non) *Trombicula scutellaris* Nagayo et al., 1920c. Ewing, 1925.

Type, *Larva*: Kitasato Research Institute.

Japan: Vole (*Microtus montebelloi*).

**TROMBICULA SCUTELLARIS Nagayo et al., 1920.**

NAGAYO, M., MITAMURA, T., & TAMIYA, T., 1920: *Nippon byorigaku Zasshi*, x, 503.

*Trombicula scutellaris* Nagayo et al., 1920c, 1921. Walch, 1922a, 1924a; Ewing, 1925; Kawamura, 1926; Patton & Evans, 1929; Radford, 1942, 1946a, 1946b; Womersley & Heaslip, 1943; Blake et al., 1945a; Finnegan, 1945; Wharton, 1946a; Sayers et al., 1947; Philip, 1947a, 1947b; Kohls, 1948; Kuwata et al., Traub et al., 1950.

*Trombicula scutellaris* Nagayo et al., 1919. Wharton, 1946a; Sayers et al., 1947.

(non) *Trombicula akamushi* (Brumpt, 1910). Ewing, 1925.

(non) *Trombicula pallida* (Nagayo et al., 1919). Ewing, 1925.

(non) *Trombicula palpalis* Nagayo et al., 1919. Ewing, 1925.

(non) *Trombicula intermedia* Nagayo et al., 1920b. Ewing, 1925.

*Saichukan*; type B Kawamura et al., 1920a.

Type, *Larva*: Kitasato Research Institute.

Paratypes, *Larvae*: S.P.H.T.M., Univ. Syd.

Japan: Rodents.

## TROMBICULA CORVI (?) Kawamura &amp; Yamaguchi, 1921.

KAWAMURA, R., & YAMAGUCHI, M., 1921: *Kita. Arch. Exper. Med.*, iv, iii, 169.  
*Trombicula corvi* (Hatori, 1919) Kawamura & Yamaguchi, 1921. Walsh & Keukenschrijver, 1924.

*Trombicula corvi* Kawamura & Yamaguchi, 1921. Kawamura, 1926; Sugimoto, 1938; Womersley & Heaslip, 1943; Finnegan, 1945; Philip & Woodward, 1946b.

I have queried this name merely because it has been stated that Hatori used it in 1919. He certainly mentioned this mite as being found on the house crow, but did not give an adequate description, and if he actually used the name it would have been a *nomen nudum*, but I think that the doubt has arisen only because of the way in which Kawamura and Yamaguchi attributed the species to Hatori; I feel that the mark of interrogation could be omitted with propriety.

## Type, Larva.

Formosa: Crow (*Corvus splendens*).

## TROMBICULA ISSHIKII Sugimoto, 1938.

SUGIMOTO, M., 1938: *J. Jap. Soc. Vet. Sci.*, xvii, i, 58.  
*Trombicula issikii* Sugimoto, 1938. Radford, 1942.  
*Trombicula issikii* Womersley & Heaslip, 1943 (*laps. cal.*). Finnegan, 1945; Philip & Woodward, 1946b.  
 Type, Larva.

Formosa: Snipe (*Capella hardwickii*).

TROMBICULA JAPONICA (Kaiwa *et al.*, 1929).

KAIWA, J., TERAMURA, S., & KAGAYA, J., 1929: *Zentralbl. f. Bakter., Parasit., u. Insekt.*, exvi, vi/viii, 23.  
*Trombicula autumnalis japonica* Kaiwa *et al.*, 1929.  
*Leptus autumnalis japonica* Kaiwa *et al.*, 1929.  
*Trombicula autumnalis japonica* Tanaka *et al.*, 1916 (?) *fide* Tanaka *et al.*, 1930. Gater, 1932; Gunther, 1940c; Womersley & Heaslip, 1943; PHILIP, 1947b.  
*Trombicula japonica* (Tanaka, 1916) Womersley & Heaslip, 1943. Finnegan, 1945; Blake *et al.*, 1945a; Wharton, 1946a; Philip & Tamiya, 1946; Philip, 1947a.  
*Trombicula japonica* (Tanaka *et al.*, 1930) PHILIP, 1947b. Philip & Fuller, 1950.  
*Akidani* Okumura, 1918; the Japanese *Leptus autumnalis* Tanaka, 1916.  
 Type, Larva: Kitasato Research Institute.  
 Japan: Man, field mouse (*Apodemus speciosus*), vole (*Microtus montebelloi*).

TROMBICULA FUJI Kuwata *et al.*, 1950.

KUWATA, T., BERGE, T. O., & PHILIP, C. B., 1950: *J. Parasit.*, xxxvi, i, 1.  
*Trombicula (Leptotrombidium) fuji* Kuwata *et al.*, 1950.  
 Type, Larva: U.S. Nat. Mus.  
 Paratypes, Larvae: Rocky Mountain Lab., Brit. Mus., S. Aust. Mus., coll. Kuwata, coll. Berge, coll. Philip.  
 Japan: Field mice (*Apodemus speciosus*, *A. geisha*).

## TROMBICULA FUJIGMO Philip &amp; Fuller, 1950.

PHILIP, C. B., & FULLER, H. S., 1950: *Parasitology*, xl, i/ii, 50.  
*Trombicula fujigmo* Philip & Fuller, 1950.  
 Type, Larva: U.S. National Museum.  
 Paratypes, Larvae: British Mus., Rocky Mountain Lab., S. Aust. Mus., coll. Wharton, coll. Tamiya, coll. Fuller, coll. Philip.  
 Japan: Shrew (*Crocidura vorax*), *Rattus sladeni*, rat.

## TROMBICULA TAMIYAI Philip &amp; Fuller, 1950.

PHILIP, C. B., & FULLER, H. S., 1950: *Parasitology*, xl, i/ii, 50.  
*Trombicula tamiyai* Philip & Fuller, 1950.  
 Type "E" Kawamura, 1926.  
 Type, Larva: U.S. National Museum.

Paratypes, *Larvae*: British Museum, Rocky Mountain Lab., S. Aust. Mus., coll. Wharton, coll. Tamiya, coll. Fuller, coll. Philip.

Japan: Field vole (*Microtus montebelloi*).

TROMBICULA OBSCURA Womersley, 1944.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, Ixviii, i, 82.

*Trombicula obscura* Womersley, 1944. Wharton, 1946a; Sayers *et al.*, 1947; Kohls, Philip & Kohls, 1948; Traub *et al.*, 1950.

(non?) *Trombicula akamushi* (Brumpt, 1910). Sayers *et al.*, 1947; (?) Philip & Kohls, 1948.

(non?) *Trombicula deliensis* Walch, 1922a. (?) Philip & Kohls, 1948.

Type, *Larva*: South Australian Museum.

New Guinea: Rat.

PART VIII.

TROMBICULA DELIENSIS, T. BURMENSIS, & T. FULLERI.

The following authorities have discussed the probability that *T. deliensis* Walch, 1922 is synonymous with *T. akamushi* (Brumpt, 1910): Gater, 1930, 1932; Heaslip, 1941; Philip & Woodward, 1946b; Philip, 1948. However, Audy & Harrison (1950) are against the idea. Further, Philip & Kohls (1948) stated outright that they reduced *deliensis* to the status of a variety of *akamushi*. Nevertheless, most of these writers at the same time agree to two broad groups, distinguishable as the *deliensis* group and the *akamushi* group. As in the case of *hirsti* and *wichmanni*, I am not yet prepared to concede complete identity, and prefer to list them separately pending further investigation at subgeneric level.

I have included *T. burmensis* and *T. fulleri* in this Part because they are both very close to *T. deliensis* and may even prove to be synonymous when more fully investigated.

TROMBICULA DELIENSIS Walch, 1922.

WALCH, E. W., 1922: *Geneesk. Tijdschr. v. Ned.-Ind.*, lxii, 5.

*Trombicula deliensis* WALCH, 1922a, 1923, 1924a, 1925, 1927. Walch & Keukenschrijver, 1923, 1924; Kawamura, 1926; Fletcher *et al.*, Warburton, 1928; Ewing, 1928, 1944a, 1944b, 1944c, 1945; Hirst, 1929a; Patton & Evans, Fletcher and Field, 1929; Manson-Bahr, 1929, 1940; Lewthwaite, 1930, 1945a, 1945b; Gater, 1930, 1932; Matheson, 1932; Dinger, 1933; Lewthwaite & Savoor, 1936a, 1936b, 1936c, 1936d, 1940; Chandler, 1936, 1949; Mehta, 1937; Herms, 1939; Gunther, 1939a, 1940a, 1940d, 1941c, 1942; Poynton, Heaslip, 1941; Radford, 1942, 1946a, 1946b, 1946c; Kouwenaar & Wolff, Burnet, 1942; Womersley & Heaslip, 1943; Banerjea & Bhattacharya, 1943, 1945; Takekawa *et al.*, Ahlm & Lipshutz, Womersley, Farner & Katsampes, Cilento, Williams, Takekawa, Cook, Bercovitz, 1944; Rogers & Megaw, 1944, 1946; U.S. War Dept., 1944, 1948; Blake *et al.*, 1945a, 1945c; Finnegan, No. 2 E.F.U., Gurbuksh Singh, Craig & Faust, Browning, Fischbach & Howell, Hayakawa Ichikawa *et al.*, Kohls *et al.*, Megaw, 1945; Mackie *et al.*, 1945, 1946; PHILIP & KOHLS, 1945, 1948; Wharton, 1946a, 1947b; Errington *et al.*, Philip & Sullivan, Roy, Michener & Fuller, H.M. Stat. Off., 1946; McCulloch, 1946, 1947; Philip & Woodward, 1946a, 1946b; Sayers *et al.*, Southecott, Millspaugh & Fuller, Hayakawa & Hokari, Griffiths, Mohr, Sadusk, Thor & Willmann, 1947; Audy, 1947, 1950; Fuller, 1947a, 1947b; PHILIP, 1947a, 1947b, 1948, 1949; Cockings, Dubois & van den Berghe, KOHLS, Smart, 1948; Gispert *et al.*, Traub, PHILIP *et al.*, 1949; Audy & Harrison, Krishnan, Pullen, Traub & Frick, Traub *et al.*, 1950; Traub & Evans, 1950b.

*Trombicula delhiensis* Stitt, 1929. Strong, 1944.

*Thrombicula delhiensis* Brumpt, 1949.

*Trombicula deliensis* Hayakawa Tanaka *et al.*, 1945. (This species is named from Deli, Sumatra, not from Delhi, India, or Dili, Timor.)

*Trombicula vanderghinstei* Gunther, 1940a, 1940d. Heaslip, 1941; Womersley & Heaslip, 1943; Womersley, 1944; Blake *et al.*, 1945a; Audy & Harrison, 1950.

*Trombicula wachtii* Womersley & Heaslip, 1943. Cook, U.S. War Dept., Womersley, 1944; McCulloch, 1944, 1946, 1947; Kohls *et al.*, Browning, Finnegan, Ewing, 1945; Blake *et al.*, 1945a, 1945c; Philip & Kohls, 1945, 1948; Philip *et al.*, 1946, 1949; Wharton, 1946a; Bushland, 1946a; Dumbleton, Mackie *et al.*, 1946; Philip & Woodward, 1946b; Sayers *et al.*, Griffiths, Sadusk, 1947; Kohls, 1948; Audy & Harrison, 1950.

(non) *Trombicula akamushi* (Brumpt, 1910). Gater, 1930, 1932; Heaslip, 1941; Philip & Woodward, 1946b; PHILIP & KOHLS, PHILIP, 1948.

Types, Adult: British Museum.—Nymph: British Museum.—Larva.

Hypotypes, Larvae: Brit. Mus., U.S. Nat. Mus., Molteno Inst., Kitasato Res. Inst., S. Aust. Mus., S.P.H.T.M., Univ. Syd., Aust. Mus., Rocky Mountain Lab.—Adult: Coll. Radford.

Sumatra, Malaya: Man.

Sumatra: Rats (*R. diardi*, *R. concolor*), pheasant (*Centrococcyx javanicus*), *Rhinorthra chlorophacea*.

Malaya: Rats (*R. diardi*, *R. jalorensis*, *R. concolor*, *R. mülleri*, *R. ciliatus*, *R. vociferans*, *Trichys fasciculata*), squirrels (*Sciurus humei*, *S. miniatus*, *S. nigrovittatus*, *Rhinosciurus tupaiooides*), shrew (*Tupaia ferruginea*), *Paradoxurus hermaphroditus*, barking deer (*Tragulus fulviventer*).

India: Rodents.

Java, Indochina, South-west China: Not specified.

Ceylon: Bandicoot (*Bandicota malabarica*), rat (*R. kandianus*), shrew (*Suncus giganteus*), gerbil (*Tatera ceylonica*), squirrel (*Funambulus favonicus*), crow (*Corvus splendens*), pheasant (*Centropus parroti*), *Endynamis scolopaceus*.

Maldives Is.: *R. norvegicus*, *R. alexandrini*, shrew (*Suncus giganteus*).

Burma: Rats (*R. concolor*, *R. norvegicus*, *R. rattus*, *R. yunnanensis*, *R. sladensis*, *R. brunneusculus*, *R. tistae*, *R. manipulus*, *R. fulvescens*, *R. nitidus*), mice (*Mus bactrianus*, *Diomys crumpi*, *Hadromys humei*, *Dremomys lokriæ*), shrews (*Tupaia belangeri*, *Suncus fulvocinereus*, *S. griffithi*, *S. murinus*, *Crocidura vorax*, *Anourosorex assamensis*), civets (*Viverra picta*, *Paradoxurus hermaphroditus*), barking deer (*Muntiacus muntjak*), monkey (*Macacus assamensis*), squirrels (*Callosciurus pygerythrus*, *C. lockroides*), bandicoots (*Bandicota bengalensis*, *B. nemorivaga*), *Gallus gallus*, *Felis domesticus*, quail (*Turnix plumipes*), hoopoe (*Upupa longirostris*), mongoose (*Herpestes* sp.), pheasant (*Centropus intermedius*).

Nepal: *R. fulvescens*.

Kanpat: *R. manipulus*.

Yunnan: *R. bowersi*.

Philippine Is.: *R. mindanensis*, *R. umbriventer*.

Formosa: *R. losca*.

New Guinea: Rats (*R. browni*, *R. mordax*, *R. praetor*, *R. gestri*, *Melomys* sp.), wallaby, bandicoot (*Echymipera cockerelli*), rail (*Rallus philippensis*), tree.

Queensland: Rats and bandicoots.

#### TROMBICULA BURMENSIS Ewing, 1945.

EWING, H. E., 1945: *Proc. Ent. Soc. Wash.*, xlvi, iii, 63.

*Trombicula burmensis* Ewing, 1945. Wharton, 1946a.

Type, Larva: U.S. National Museum.

Burma: Rats.

#### TROMBICULA FULLERI Ewing, 1945.

EWING, H. E., 1945: *Proc. Ent. Soc. Wash.*, xlvi, iii, 63.

*Trombicula fulleri* Ewing, 1945. Wharton, 1946a; Sayers *et al.*, 1947; Kohls, 1948; Traub *et al.*, 1950.

Type, Larva: U.S. National Museum.

Burma: Shrews.

## PART IX.

## THE TROMBICULAE OF MALAYA &amp; THE EAST INDIES.

Certain of these species have already been dealt with in previous Parts:

*T. minor* Berlese, 1905 (Java), Part V; *T. mediocris* Berlese, 1912 (Java), Part V; *T. wuchmanni* (Oudemans, 1905) (Celebes & B.N. Borneo), Part VI; *T. akamushi* (Brumpt, 1910) (Malaya), Part VII; *T. deliensis* Walch, 1922 (Sumatra, Java, & Malaya), Part VIII; *T. hirsti* Sambon, 1927 (Malaya, Sumatra, & Celebes), Part V.

## TROMBICULA ACUSCUTELLARIS Walch, 1923.

WALCH, E. W., 1923: *Kita. Arch. Exper. Med.*, v, iii, 63.

*Trombicula acuscutellaris* Walch, 1923, 1925. Patton & Evans, 1929; Gater, 1932; Lewthwaite & Savoor, 1936c; Thor, 1936; Mehta, 1937; Gunther, 1941c; Radford, 1942, 1946b; Williams, 1944; Blake *et al.*, 1945a; Finnegan, 1945; Mackie *et al.*, Roy, Philip *et al.*, 1946; Ewing, 1946a; Wharton, 1946b; Philip & Woodward, 1946b; Thor & Willmann, 1947; Fuller, 1947b; Philip, 1947b; Sayers *et al.*, 1947.

*Thrombicula acuscutellaris* Walch, 1922. Brumpt, 1949.

*Trombidium acuscutellare* Walch, 1927.

*Pentagonella acuscutellaris* Thor, 1936.

*Trombicula (Pentagonella) acuscutellaris* (Walch, 1923) Womersley & Heaslip, 1943.

Type, *Nymph*: British Museum.—*Larva*.

Hypotypes, *Larva*: British Museum.—*Nymph*: Coll. Radford.

Malaya: Man.

Malaya & Sumatra: *R. diardi*.

Ceylon & Maldive Is.: *R. norvegicus*.

## TROMBICULA DENSIPILATA Walch, 1923.

WALCH, E. W., 1923: *Kita. Arch. Exper. Med.*, v, iii, 63.

*Trombicula densipilata* Walch, 1923, 1925. Patton & Evans, 1929; Gunther, 1941c; Radford, 1942, 1946b; Womersley & Heaslip, 1943; Finnegan, 1945; Blake *et al.*, 1945a; Dumbleton, 1946.

Type, *Larva*.

Sumatra: Rat.

Nissan Is., New Guinea: Rat.

## TROMBICULA (?) KEUKENSCHRIJVERI Walch, 1924.

WALCH, E. W., 1924: *Trans. 5th Bienn. Cong. Far East. Ass. Trop. Med.*, 583.

*Trombicula keukenschrijveri* Walch, 1924a, 1924b, 1925. Walch & Keukenschrijver, 1924; Gater, 1932; Gunther, 1941c; Blake *et al.*, 1945a; Wharton, 1946a; Philip & Woodward, 1946b.

*Trombicula keukenschrijveri* Walch, 1923: Womersley & Heaslip, 1943; Finnegan, 1945.

Apparently Walch did not acknowledge any other genus but *Trombicula* (cf. *Trombicula vandersandei* Walch, 1923, for *Thrombidium van der Sandei* Oudemans, 1905, and *Schöngastia vandersandei* Oudemans, 1912, and various other examples). Therefore we cannot even assume that in the absence of the sensillae Walch placed *keukenschrijveri* in the genus *Trombicula* because of other generic characters, and I retain it here merely because, though it has no ostensible right to this generic placing other than that Walch originally put it there, there is nowhere else to place it, and no sense in pushing it around.

Type, *Larva*.

Paratypes, *Larvae*: British Museum, U.S. National Museum.

Sumatra: Man.

Malaya: *R. ciliatus*.

## TROMBICULA RARA Walch, 1924.

WALCH, E. W., 1924: *Trans. 5th Bienn. Cong. Far East. Ass. Trop. Med.*, 583.

*Trombicula rara* Walch, 1924a, 1925. Walch & Keukenschrijver, 1924; Gunther, 1941c; Womersley & Heaslip, 1943; Kohls *et al.*, Finnegan, 1945; Blake *et al.*, 1945a; Philip & Woodward, 1946b.

*Trombicula (Eutrombicula) rara* (Walch, 1924) Philip & Woodward, 1946b.

Type, *Larva*.

Sumatra: Man.

Dutch New Guinea: Skink (*Lygosoma variegatus*), free.

TROMBICULA (?) HASTATA Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Trombicula hastata* Gater, 1932. Radford, 1942.

*Neoschöngastia hastata* Womersley & Heaslip, 1943.

*Ascoshöngastia hastata* Womersley & Kohls, 1947.

Gater placed *hastata* in the genus *Trombicula* in spite of the absence of sensillae. Its anteromedian and posterolateral scutal setae are leaf-shaped. Now, in 1940, I described *N. foliata* from New Guinea—*foliata* has its posterolateral scutal setae (but not its anteromedian) broad and leaf-shaped, and because of this partial resemblance Womersley & Heaslip (1943) transferred *hastata* to *Neoschöngastia*, and in 1947 Womersley & Kohls went further and made it *Ascoshöngastia*. These workers are probably quite right, but until the type of the sensillae of *hastata* is established I can see no justification in transferring it about on purely hypothetical grounds.

Type, *Larva*: British Museum.

Malaya: *R. surifer*.

TROMBICULA MUNDA Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Trombicula munda* Gater, 1932. Radford, 1942; Womersley & Heaslip, 1943; Finnegan, 1945; Audy, 1947; Philip & Fuller, 1950.

Type, *Larva*: British Museum.

Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.

Malaya: Rats (*R. diardi*, *R. mülleri*, *R. malaisia*).

TROMBICULA SPICEA Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Trombicula spicea* Gater, 1932. Radford, 1942; Womersley & Heaslip, 1943; Finnegan, 1945; Philip & Fuller, 1950.

Type, *Larva*: British Museum.

Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.

Malaya: Rats (*R. malaisia*, *R. mülleri*).

TROMBICULA BODENSIS Gunther, 1940.

GUNTHER, C. E. M., 1940: PROC. LINN. SOC. N.S.W., lxxv, iii/iv, 479.

*Trombicula bodensis* Gunther, 1940b. Womersley & Heaslip, 1943; Finnegan, 1945; Philip et al., McCulloch, 1946; Philip & Woodward, 1946b.

Type, *Larva*: School Public Health Tropical Medicine, Univ. Sydney.

Paratypes, *Larvae*: British Museum, Australian Museum, South Australian Museum.

B.N. Borneo: Mouse deer (*Tragulus borneanus*).

Philippine Is.: Rat.

TROMBICULA BATUI Philip & Traub, 1950.

PHILIP, C. B., & TRAUB, R., 1950: *J. Parasit.*, xxxvi, i, 29.

*Trombicula batui* Philip & Traub, 1950.

Holotype, *Larva*: U.S. National Museum (Type No. 1865).

Paratypes, *Larvae*: British Museum, Rocky Mountain Laboratory (No. AP 25759), Chicago Natural History Museum.

Batu caves, Selangor: Bat (*Eonycteris spelaea*).

TROMBICULA INSOLLI Philip & Traub, 1950.

PHILIP, C. B., & TRAUB, R., 1950: *J. Parasit.*, xxxvi, i, 29.

*Trombicula insolli* Philip & Traub, 1950.

Holotype, *Larva*: U.S. National Museum (No. 1866).

Paratypes, *Larvae*: British Museum, Rocky Mountain Laboratory.

Batu caves, Selangor: Bat (*Eonycteris spelaea*).

## PART X.

## THE TROMBICULAE OF INDIA &amp; BURMA.

The following species have already been dealt with in previous Parts:

*T. akamushi* (Brumpt, 1910) (Burma, Ceylon, Maldives, Nepal), Part VII; *T. deliensis* Walch, 1922 (India, Ceylon, Maldives, Kanpat, Nepal, Burma), Part VIII; *T. burmensis* Ewing, 1945 (Burma), Part VIII; *T. fulleri* Ewing, 1945 (Burma), Part VIII; *T. hakei* Radford, 1946 (Imphal), Part VI.

## TROMBICULA GLIRICOLENS (Hirst, 1915) Radford, 1942.

HIRST, S., 1915: *Bull. Ent. Res.*, vi, iii, 183; RADFORD, C. D., 1942: *Parasitology*, xxxiv, 55.

*Microtrombidium gliricolens* Hirst, 1915b.

*Trombicula gliricolens* Radford, 1942. WOMERSLEY & HEASLIP, 1943; FINNAGAN, 1945; Dumbleton, 1946.

Type, Larva: British Museum.

Bengal: *Mus rattus*.

## TROMBICULA CERVULICOLA Ewing, 1931.

EWING, H. E., 1931: *Proc. U.S. Nat. Mus.*, lxxx, No. 2908, 1.

*Trombicula cervulicola* Ewing, 1931. Radford, 1942; WOMERSLEY & HEASLIP, 1943.

Type, Larva: U.S. National Museum.

India: Barking deer (*Muntiacus aureus*).

## TROMBICULA COLUBERINA (Radford, 1946).

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.

*Fonsecia coluberina* Radford, 1946c. SAYERS *et al.*, 1947.

Strictly speaking, following the new subgenera of Wharton *et al.*, 1951, this species should be listed as *Trombicula (Fonsecia) coluberina* (Radford, 1946), but, as already explained, it is not feasible to introduce subgenera in this list.

Type, Larva: British Museum.

Paratypes: Coll. Radford, coll. André, U.S. Nat. Mus.

India: Snake (*Coluber radiatus*).

## TROMBICULA SQUAMOSUS (Radford, 1948).

RADFORD, C. D., 1948: *Proc. Zool. Soc.*, cxviii, i, 126.

*Trombiculindus squamosus* Radford, 1948.

This species has been made the type of the new subgenus *Trombiculindus* Wharton *et al.*, 1951, and should therefore be listed as *Trombicula (Trombiculindus) squamosus* (Radford, 1948), but I am not using subgenera in this list.

Lectotype, Larva: British Museum.

Paratypes, Larvae: U.S. Nat. Mus., S. Aust. Mus., coll. Willmann, Musée d'Hist. Natur., Paris, coll. Kalra, coll. du Toit, coll. Radford, coll. André, coll. Brennan.

India: Rat.

## PART XI.

## THE TROMBICULAE OF THE SOUTH-WEST PACIFIC.

The following species have already been dealt with in previous Parts:

*T. wichmanni* (Oudemans, 1905) (Philippine Is., New Guinea), Part VI; *T. akamushi* (Brumpt, 1910) (Philippine Is., New Guinea), Part VII; *T. deliensis* Walch, 1922 (Philippine Is., New Guinea), Part VIII; *T. densipilata* Walch, 1923 (Nissan Is., N.G.), Part IX; *T. rara* Walch, 1924 (Dutch New Guinea), Part IX; *T. hirsti* Sampon, 1927 (New Guinea), Part V; *T. obscura* WOMERSLEY, 1944 (New Guinea), Part VII.

*T. quadriense* WOMERSLEY & HEASLIP, 1943 (British Solomon Islands) will be dealt with in Part XII.

## TROMBICULA PIERCEI Ewing, 1933.

EWING, H. E., 1933: *Proc. U.S. Nat. Mus.*, lxxii, xxix, 1.

*Trombicula piercei* Ewing, 1933. Radford, 1942; Philip & Traub, 1950.

Lectotype & Cotypes, Larvae: U.S. National Museum.

Philippine Is.: Bat. (*Hipposideros diadema*).

## TROMBICULA RIOI Gunther, 1939.

GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., Ixiv, i/ii, 73.  
*Trombicula edwardsi* Gunther, 1938 (*nom. nud.*).

*Trombicula rioi* Gunther, 1939a, 1940a, 1940d, 1942. Womersley, 1939; Radford, 1942;  
 Womersley & Heaslip, 1943; Blake *et al.*, 1945a; Finnegan, 1945.

Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

Paratypes, *Larvae*: Brit. Mus., Australian Mus., S. Aust. Mus., Rocky Mountain Lab.  
 New Guinea: Bush fowl (*Megapodius reinwardt*).

## TROMBICULA ROBUSTA Gunther, 1941.

GUNTHER, C. E. M., 1941: PROC. LINN. SOC. N.S.W., Ixvi, iii/iv, 157.  
*Trombicula robusta* Gunther, 1941b. Womersley & Heaslip, 1943; Finnegan, 1945.

Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

Paratypes, *Larvae*: Australian Museum, British Museum.

New Guinea: Catbird (*Ailuroedus melanoccephalus*), pitta (*P. mackloti*).

## TROMBICULA KOHLSI Womersley, 1944.

WOMERSLEY, H., 1944: Trans. Roy. Soc. S. Austral., Ixviii, i, 82.  
*Trombicula kohlsi* Womersley, 1944. Kohls *et al.*, 1945.

Type, *Larva*: South Australian Museum.

New Guinea: Skink (*Lygosoma variegatus*), free.

## TROMBICULA SCINCOIDES Womersley, 1944.

WOMERSLEY, H., 1944: Trans. Roy. Soc. S. Austral., Ixviii, i, 82.  
*Trombicula scincoides* Womersley, 1944. Blake *et al.*, 1945a; Kohls *et al.*, 1945; Philip & Woodward, 1946b; Bushland, 1946b; Philip *et al.*, 1946.

Type, *Larva*: South Australian Museum.

New Guinea: Skink (*Lygosoma bicarinatus*), lizards (*Leiolepisma fuscum*, *L. albertisii*), free.

Philippine Is.: Skinks, lizards.

## TROMBICULA FRITTSI Wharton, 1945.

WHARTON, G. W., 1945: J. Parasit., xxxi, iv, 282.  
*Trombicula frittsi* Wharton, 1945a. Philip & Fuller, 1950.

Type, *Larva*: U.S. National Museum. Paratype, *Larva*: Coll. Radford.

Bougainville Is.: *Rattus praetor*, *Gehyra oceanica*, *Varanus indica*.

## TROMBICULA ANOUS (Wharton, 1945).

WHARTON, G. W., 1945: J. Parasit., xxxi, vi, 401.  
*Acariscus anous* Wharton, 1945b, 1946b, 1947b.

Type, *Larva*: U.S. National Museum.

Paratypes, *Larvae*: U.S. National Museum, S. Australian Museum, coll. Radford.  
 Guam: Noddy (*Anous stolidus*), tattler (*Heteroscelus incanus*).

## TROMBICULA PLUVIUS (Wharton, 1945).

WHARTON, G. W., 1945: J. Parasit., xxxi, vi, 401.  
*Acariscus pluvius* Wharton, 1945b, 1946b, 1947b.

Type, *Larva*: U.S. National Museum.

Paratypes, *Larvae*: U.S. National Museum, S. Australian Museum, coll. Radford.

Guam, Bougainville Is.: Plover (*Pluvialis dominica*), noddies (*Anous tenuirostris*, *A. stolidus*), tattler (*Heteroscelus incanus*).

## TROMBICULA NISSANI Dumbleton, 1946.

DUMBLETON, L. J., 1946: Trans. Roy. Soc. N.Z., Ixxvi, iii, 409.  
*Trombicula nissani* Dumbleton, 1946.

Type & Paratypes, *Larvae*: South Australian Museum.  
 Nissan Is., N.G.: Tree kangaroo.

## TROMBICULA GYMNODACTyla (Womersley &amp; Kohls, 1947).

WOMERSLEY, H., & KOHLS, G. M., 1947: *Trans. Roy. Soc. S. Aust.*, Ixxi, i, 3.

*Trombicula gymnodactyla* McCulloch, 1946 (*nom. nud.*).

*Eutrombicula gymnodactyla* Womersley & Kohls, 1947.

*Eutrombicula (Acariscus) gymnodactyla* Womersley & Kohls, 1947.

McCulloch (1946) published a paper in which he mentioned "*Trombicula gymnodactyla* (Womersley MS.)". Womersley & Kohls (1947) published the full description of their species as *Eutrombicula gymnodactyla* and *Eutrombicula (Acariscus) gymnodactyla* in the same paper, explaining that they regarded *Acariscus* as a synonym of *Eutrombicula*.

Type, *Larva*: South Australian Museum.

Paratypes, *Larvae*: South Australian Museum, U.S. National Mus.

Dutch New Guinea: *Gymnodactyla louisiadensis*.

## PART XII.

## THE TROMBICULAE OF AUSTRALIA &amp; NEW ZEALAND.

The following species have already been dealt with in previous Parts:

*T. deliensis* Walch, 1922 (Australia), Part VIII; *T. hirsti* Sambon, 1927 (Australia), Part V.

Although this check list purports to deal only with larvae, I have already included two species known only from the adults (*T. minor* and *T. deliensis*), and I am including here three more (*T. signata*, *T. tindalei*, and *T. translucens*).

## TROMBICULA NOVAE-HOLLANDIAE Hirst, 1929.

HIRST, S., 1929: *Proc. Zool. Soc. Lond.*, ii, 165.

*Trombicula novae-hollandiae* Hirst, 1929b, 1929c, 1929d. Womersley, 1934, 1936, 1937, 1939; Gunther, 1939a; Radford, 1942; Womersley & Heaslip, 1943; Finnegan, 1945.

Type, *Larva*: British Museum.

Paratype, *Larva*: South Australian Museum.

Australia: *Rattus greyii*, rat-kangaroo (*Potorous tridactylus*).

## TROMBICULA SAMBONI (Hirst, 1929) Womersley, 1939.

HIRST, S., 1929: *Ann. Mag. Nat. Hist.*, x, iii, 564; WOMERSLEY, H., 1939: *Trans. Roy. Soc. S. Aust.*, Ixiii, ii, 149.

*Trombicula hirsti* Sambon, 1927. Hirst, 1929a, 1929c, 1929d. Womersley, 1934, 1936, 1937.

*Trombicula samboni* Womersley, 1939. Womersley & Heaslip, 1943; Gill et al., 1945; McCulloch, 1946, 1947; Fuller, 1947b.

*Trombicula samboni* Womersley, 1936. Finnegan, 1945.

*Trombicula sanboni* McCulloch, 1944 (*laps. cat.*).

(non) *Trombicula hirsti* Sambon, 1927.

*T. hirsti* occurs in the northern part of Australia. Both Hirst and Womersley, working with similar specimens from South Australia, believed that they were working with *hirsti*, but in 1939 Womersley obtained some of Sambon's paratypes and discovered that the southern specimens were different; these he named *T. samboni*.

Type, *Larva*: South Australian Museum.

South Australia: Man.

## TROMBICULA SIGNATA Womersley, 1934.

WOMERSLEY, H., 1934: *Rec. S. Aust. Mus.*, v, ii, 179.

*Trombicula signata* Womersley, 1934, 1937.

Type, *Adult*: South Australian Museum.

Western Australia: Free.

## TROMBICULA TINDALEI Womersley, 1936.

WOMERSLEY, H., 1936: *Linn. Soc. J.: Zool.*, xl, clxix, 107.*Trombicula tindalei* Womersley, 1936, 1937.

Type, Adult: S. Australian Museum.

Kangaroo Is., S. Australia: Free.

## TROMBICULA MACROPUS Womersley, 1936.

WOMERSLEY, H., 1936: *Linn. Soc. J.: Zool.*, xl, clxix, 107.*Trombicula macropus* Womersley, 1936, 1939. Gunther, 1939a; Womersley & Heaslip, 1943; Finnegan, 1945.*Trombicula macropus* Womersley, 1934. Womersley, 1937.

Type, Larva: South Australian Museum.

Northern Territory, Australia: Wallaby (*Macropus* sp.).

## TROMBICULA CHIROPTERA Womersley &amp; Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.*Trombicula chiroptera* Womersley & Heaslip, 1943. Finnegan, 1945.

Type, Larva: South Australian Museum.

South Australia (?): Rats (?), *Chalinolabus gouldi*.

## TROMBICULA QUADRIENSE Womersley &amp; Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.*Trombicula quadriense* Womersley & Heaslip, 1943. Finnegan, 1945; Dumbleton, 1946.

Type, Larva: South Australian Museum.

Queensland: *Rattus assimilis*, *Hydromys chrysogaster*, rat.

## TROMBICULA SARCINA Womersley, 1944.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, lxviii, i, 82.*Trombicula sarcina* Womersley, 1944. Legg, 1944; Gill et al., 1945; McCulloch, 1947; Chandler, 1949.

Type, Larva: South Australian Museum.

Queensland: Man, sheep, dog, kangaroo (*Macropus major*), wallaroos, wallabies, apostle bird (*Struthidius cinereus*), free.

## TROMBICULA TRANSLUCENS Womersley, 1944.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, lxviii, i, 82.*Trombicula translucens* Womersley, 1944.

Type, Adult: South Australian Museum.

Queensland: Free.

## TROMBICULA NAULTINI Dumbleton, 1946.

DUMBLETON, L. J., 1946: *Trans. Roy. Soc. N.Z.*, lxxvi, iii, 409.*Trombicula naultini* Dumbleton, 1946.

Type, Larva: Entomol. Division, Nelson, N.Z.

New Zealand: *Naultinus elegans*.

## PART XIII.

## GENUS SCHÖNGASTIA Oudemans, 1910.

OUDEMANS, A. C., 1910: *Ent. Ber. Ned. Ent. Ver.*, iii, liv, 86.*Schöngastia* Oudemans, 1910a, 1912b. Walch, 1927; Sampon, 1928; Hirst, 1929a; Vitzthum, 1929; Ewing, 1929, 1938, 1944a, 1944b; Gater, 1932; Thor, 1935, 1936; Womersley, 1937, 1939; Gunther, 1939a, 1941c; Womersley & Heaslip, 1943; Thor & Willmann, 1947; Lawrence, 1949; WHARTON et al., 1951.*Schöngastia* Warburton, 1928 (*laps. cal.*).(non) *Trombicula* Berlese, 1905: Walch, 1923, 1924a, 1925, 1927; Walch & Keukenschrifver, 1923, 1924; Fletcher et al., 1928; Patton & Evans, Manson-Bahr, 1929.(non) *Leptus* Latreille, 1804: Warburton, 1928.

(non) *Schöngastia* Oudemans, 1910: Hirst, 1929a, 1929b, 1929c, 1929d; Womersley, 1934, 1937; Radford, 1942; U.S. War Dept., 1944.

(non) *Neoschöngastia* Ewing, 1929. Radford, 1942; Womersley & Heaslip, 1943.

Genotype, *Schöngastia vandersandei* (Oudemans, 1905) Oudemans, 1912.

A peculiar thing has happened with regard to a member of this genus: Wharton *et al.*, in 1951, made their first division of the larval Trombiculidae on the basis of the numbers of leg segments (which does not appeal to me, from the practical aspect, as a good starting-point). Now, *S. oudemansi* (Walch, 1923) has seven leg-segments in legs I, but six in legs II and III—a similar condition to that existing in *Neoschöngastia impar* Gunther, 1939. Apart from this variation in leg segments, *S. oudemansi* has all the characteristics of the genus *Schöngastia*—yet we are threatened with its being taken out of its seat in the Trombiculinae and placed, as the type of a new genus, into the Walchiinae alongside totally different genera such as *Walchia* and *Gahriepia*. This seems artificial to me, and I am leaving *S. oudemansi* for the present in the genus *Schöngastia*.

Apart from this one point, my arrangement of this Part is quite orthodox. I have not accepted as fully proven the identification of *S. blestowei* with *S. vandersandei*, and of *S. pusilla* with *S. schüffneri*, but have retained them as distinct.

#### SCHÖNGASTIA VANDERSANDEI (Oudemans, 1905) Oudemans, 1912.

OUDEMANS, A. C., 1905: *Ent. Ber. Ned. Ent. Ver.*, i, xxii, 216; *Idem*, 1912: *Zool. Jahrb.*, xiv, i, 1.

*Thrombidium van der Sandei* Oudemans, 1905, 1906, 1910c. Fantham *et al.*, 1916.

*Schöngastia vandersandei* Oudemans, 1912b, 1913, 1916. Hirst, 1917; Ewing & Hartzell, 1918; Sambon, 1927; Gunther, 1939a, 1940d, 1941c, 1942; Womersley, 1939; Radford, 1942; Womersley & Heaslip, 1943; Ewing, 1944a, 1944b; Finnegan, 1945; Dumbleton, 1946; Thor & Willmann, 1947; Philip & Kohls, 1948; Traub *et al.*, 1950.

*Schöngastia van der sandei* (Oudemans, 1905) Brumpt, 1949.

*Trombicula vandersandei* Walch, 1923, 1924a. Patton & Evans, 1929.

*Microtrombidium vandersandei* Warburton, 1928.

(non) *Schöngastia blestowei* Gunther, 1939a. Dumbleton, 1946; Philip & Kohls, 1948; Traub *et al.*, 1950.

*Akran* (Patton & Evans, 1929), *gonone* (Oudemans, 1906).

Type, *Larva*.

Dutch New Guinea, British Solomon Is.; Man.

#### SCHÖNGASTIA OUDEMANSI (Walch, 1923) Gater, 1932.

WALCH, E. W., 1923: *Kita. Arch. Exper. Med.*, v, iii, 63; GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Trombicula oudemansi* Walch, 1923, 1924a, 1925, 1927. Walch & Keukenschrijver, 1924; Fletcher *et al.*, 1928; Patton & Evans, 1929; Hayakawa Tanaka *et al.*, 1945; Hayakawa & Hokari, 1947.

*Schöngastia oudemansi* Gater, 1932. Gunther, 1939a, 1940b, 1941c; Womersley & Heaslip, 1943; Blake *et al.*, 1945a; Radford, 1946b; Hayakawa & Hokari, Thor & Willmann, 1947; Audy & Harrison, 1950; WHARTON *et al.*, 1951.

*Neoschöngastia oudemansi* Walch, 1923. Radford, 1942; Finnegan, 1945.

(non) *Microtrombidium oudemansi* von Goosmann, 1917.

Type, *Larva*.

Paratypes, *Larvae*: British Museum, U.S. National Mus., Molteno Inst.

Sumatra: Man, rats (*R. jalorensis*, *R. diardi*, *R. concolor*), tiger cat.

Malaya: Rats (*R. diardi*, *R. jalorensis*, *R. mülleri*, *R. ciliatus*), *Trichys fasciculata*, squirrels (*Sciurus miniatus*, *Rhinosciurus laticaudatus*), shrew (*Tupaia ferruginea*), mouse-deer (*Tragulus fulviventer*).

## SCHÖNGASTIA SCHÜFFNERI (Walch, 1923) Gunther, 1941.

WALCH, E. W., 1923: *Kita. Arch. Exper. Med.*, v, iii, 63; GUNTHER, C. E. M., 1941: PROC. LINN. SOC. N.S.W., lxvi, v/vi, 391.

*Trombicula schüffneri* Walch, 1923, 1924a, 1925. Walch & Keukenschrijver, 1923, 1924, 1925; Warburton, Fletcher *et al.*, 1928; Patton & Evans, Manson-Bahr, 1929; Matheson, 1932; Poynton, 1941; Kouwenaar & Wolff, 1942; Farner & Katsampes, Takekawa, 1944; No. 2 E.F.U., Craig & Faust, 1945; Lewthwaite, 1945b; Hayakawa & Hokari, 1947.

*Trombicula shüffneri* Warburton, 1928. Strong, 1944.

*Thrombicula schüffneri* Walch, 1924. Brumpt, 1949.

*Schöngastia schüffneri* Gunther, 1941c. Williams, 1944; Blake *et al.*, 1945a; Wharton, 1946a; Griffiths, Sayers *et al.*, Mohr, Hayakawa & Hokari, 1947; Philip & Kohls, 1948.

*Neoschöngastia schüffneri* Walch, 1923. Radford, 1942; Womersley & Heaslip, 1943; Finnegan, 1945.

(non) *Schöngastia pusilla* Womersley, 1944. Griffiths, 1947; Philip & Kohls, 1948. Type, Larva.

Sumatra: Man, pheasant (*Centrococcyx javanicus*), rodents.

## SCHÖNGASTIA PSEUDO-SCHÜFFNERI (Walch, 1927) Gunther, 1941.

WALCH, E. W., 1927: *Geneesk. Tijdschr. v. Ned.-Ind.*, lxvii, 922; GUNTHER, C. E. M., 1941: PROC. LINN. SOC. N.S.W., lxvi, v/vi, 391.

*Trombicula pseudo-schüffneri* Walch, 1927.

*Schöngastia pseudo-schüffneri* Gunther, 1941c.

*Neoschöngastia pseudoschüffneri* Walch, 1927. Womersley & Heaslip, 1943. Type, Larva.

Sumatra: Man, *Rattus diardi*.

## SCHÖNGASTIA VIETA Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Schöngastia vieta* Gater, 1932. Radford, 1942; Womersley & Heaslip, 1943.

Type, Larva: British Museum.

Paratypes, Larvae: U.S. National Mus., Molteno Inst.

Malaya: Rats (*R. diardi*, *R. jalorensis*, *R. mülleri*).

## SCHÖNGASTIA BLESTOWEI Gunther, 1939.

GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., lxiv, i/ii, 73.

*Schöngastia yeomansi* Gunther, 1938 (nom. nud.). Womersley, 1944.

*Schöngastia blestowei* Gunther, 1939a, 1940a, 1940d, 1941c, 1942. Womersley, 1939, 1944; Radford, 1942; Womersley & Heaslip, 1943; McCulloch, 1944, 1946; Finnegan, Kohls *et al.*, Anderson & Wing, Philip & Kohls, 1945; Blake *et al.*, 1945a, 1945c; Wharton, 1946a; Bushland, 1946a, 1946b, 1946c; Dumbleton, 1946; Fuller, 1947b; Griffiths, Southcott, Mohr, 1947; Kohls, Philip & Kohls, 1948; Traub *et al.*, 1950.

*Schöngastia blestowei* (J. de Vidas, 1945) Brumpt, 1949.

*Schöngastia blestowei* v. *megapodius* Womersley & Heaslip, 1943. Finnegan, 1945.

(?) *Leeuwenhoekia blestowei* Gunther. Finnegan, 1945.

(non) *Schöngastia vandersandei* (Oudemans, 1905). Dumbleton, 1946; Philip & Kohls, 1948; Traub *et al.*, 1950.

*Bush-mokka, pipi, gugung* (New Guinea: Gunther, 1939a).

Type, Larva: School Public Health Trop. Med., Univ. Sydney.

Paratypes, Larvae: British Mus., Australian Mus., S. Australian Mus., Rocky Mountain Lab.

New Guinea: Man, bush fowl (*Megapodius reinwardt*), lizards, snakes, birds, *Rattus browni*, bandicoot (*Echymipera cockerelli*), wallaby, tree.

Philippine Is.: Rats.

## SCHÖNGASTIA JAMESI Gunther, 1939.

- GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., lxiv, i/ii, 73.  
*Schöngastia rotunda* Gunther, 1938 (*nomen nudum*).  
*Schöngastia jamesi* Gunther, 1939a, 1940d, 1941c, 1942. Womersley, 1939; Radford, 1942; Womersley & Heaslip, 1943; Finnegan, 1945.  
*Schöngastia jamesi* Blake *et al.*, 1945a (*laps. cal.*).  
Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.  
Paratype, *Larva*: Australian Museum.  
New Guinea: Bush fowl (*Megapodius reinwardt*), bandicoot (*Echymipera cockerelli*).

## SCHÖNGASTIA TAYLORI Gunther, 1940.

- GUNTHER, C. E. M., 1940: PROC. LINN. SOC. N.S.W., lxv, iii/iv, 250.  
*Schöngastia taylori* Gunther, 1940a, 1940d, 1941c. Womersley & Heaslip, 1943; Blake *et al.*, 1945a.  
Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.  
Paratypes, *Larvae*: British Mus., Australian Mus., S. Australian Mus., Rocky Mountain Lab.  
New Guinea: Wallaby.

## SCHÖNGASTIA KATONIS Womersley &amp; Heaslip, 1943.

- WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.  
Carasosu-mite of Kato: Kawamura & Yamaguchi, 1921. Walch, 1923, 1924a.  
*Schöngastia katonis* Womersley & Heaslip, 1943.

Type, *Larva*.

Parao Is.: Man.

## SCHÖNGASTIA PUSILLA Womersley, 1944.

- WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, lxviii, i, 82.  
*Schöngastia pusilla* Womersley, 1944. McCulloch, 1944, 1946; Philip & Kohls, 1945, 1948; Blake *et al.*, 1945a, 1945c; Kohls *et al.*, 1945; Bushland, 1946a, 1946b, 1946c; Fuller, 1947b; Griffiths, Mohr, 1947; Kohls, 1948.  
*Schöngastia pusilla* (J. de Vidas, 1945) Brumpt, 1949.  
(*non*) *Schöngastia schüffneri* (Walch, 1923). Griffiths, 1947; Philip & Kohls, 1948.  
Type, *Larva*: South Australian Museum.  
New Guinea: Man, rats, free.  
Philippine Is.: Rats.

## SCHÖNGASTIA MALDIVENSIS Radford, 1946.

- RADFORD, C. D., 1946: *Parasitology*, xxxvii, i/ii, 46.  
*Schöngastia maldivensis* Radford, 1946b.  
Types, *Nymph* & *Larva*: British Museum.  
Paratypes, *Nymph*: Coll. Radford. *Larvae*: U.S. Nat. Mus., Coll. Radford, Coll. Brennan, Coll. André.  
Maldive Is.: Lizard (*Calotes versicolor*), *R. norvegicus*.

## SCHÖNGASTIA PHILIPPI Womersley &amp; Kohls, 1947.

- WOMERSLEY, H., & KOHLS, G. M., 1947: *Trans. Roy. Soc. S. Aust.*, lxxi, i, 3.  
*Schöngastia philippi* Womersley & Kohls, 1947.  
Type, *Larva*: South Australian Museum.  
Paratypes, *Larvae*: S. Australian Museum, British Museum, U.S. National Museum, Rocky Mountain Laboratory.  
Goodenough Is., N.G.: Lizard (*Leiolepisma albertisii*).

NOTE.—For the benefit of anyone seeking names for future species, it should be recorded that a *nomen nudum* (*Schöngastia parva* McCulloch, 1946) and a misidentification (*Schöngastia minor* U.S. War Dept., 1944) have confused these specific names for this genus.

## PART XIV.

## GENUS NEOSCHÖNGASTIA Ewing, 1929.

EWING, H. E., 1929: A Manual of External Parasites, London.

*Schöngastia* Oudemans, 1910a (*partim*). Hirst, 1915b, 1929a, 1929b; Ewing, 1925.

*Neoschöngastia* EWING, 1929, 1938, 1942, 1944a, 1944b, 1946b. Gater, 1932; Thor, 1935, 1936; Fonseca, 1936; WOMERSLEY, 1937, 1939; Gunther, 1939a, 1940a, 1942; WOMERSLEY & HEASLIP, 1943; RADFORD, 1946c; WOMERSLEY & KOHLS, THOR & WILLMANN, 1947; PHILIP & WOODWARD, 1946b; WHARTON & HARDCASTLE, 1946; LAWRENCE, 1949; JONES, 1950; WHARTON *et al.*, 1951.

*Paraschöngastia* WOMERSLEY, 1939. Gunther, 1940a; EWING, 1942, 1944a, 1944b, 1946b; WHARTON & HARDCASTLE, 1946.

(non) *Trombicula* Berlese, 1905. WALCH, 1923, 1924a, 1925, 1927; FLETCHER *et al.*, 1928; PATTON & EVANS, 1929.

(non) *Trombidium* WALCH, 1927.

(non) *Schöngastia* Oudemans, 1910a. HIRST, 1929a, 1929b, 1929c, 1929d; WOMERSLEY, 1934, 1937.

Genotype, *Neoschöngastia americana* (Hirst, 1921).

In 1939 WOMERSLEY investigated several species of *Neoschöngastia* described by me from New Guinea, and erected a new genus, *Paraschöngastia*, to accommodate certain of them. But EWING (1946b) re-examined the genotype of his genus *Neoschöngastia*, *N. americana* (Hirst, 1921), and found that it had the special scutal characteristics of WOMERSLEY'S *Paraschöngastia*. Consequently, *Paraschöngastia* reverted as a synonym of *Neoschöngastia*, and EWING erected *Ascoschöngastia* to accommodate those species of *Neoschöngastia* which lacked the special scutal characteristics. Unfortunately this did not solve things, because EWING selected *N. malayensis* GATER, 1932, as the genotype of *Ascoschöngastia*, and it has its postero-lateral scutal setae placed alongside, not upon, its scutum, and if this is to be regarded as a generic character (and even more trivial characters are being so regarded these days), the remainder of the unspecialized members of *Neoschöngastia* have only *Euschöngastia* EWING, 1938, to go to, and in EWING'S original definition *Euschöngastia* has 5 to 7 palpal claws in 2 or 3 pairs.

In fact, the whole situation is quite unsatisfactory, as will be evident if we consider, for example, the well-known species originally described by HIRST (1915) as *Schöngastia indica*; this species has been labelled *Neoschöngastia*, *Euschöngastia*, and *Ascoschöngastia* by equally competent authorities within the last few years. The key given by WHARTON *et al.* (1951) does not solve the problem either. So I am hereby taking the bull by the horns and regarding *Ascoschöngastia* as containing only *A. malayensis*, and *Euschöngastia* as containing only *E. sciuricola* (EWING, 1925) EWING, 1938, and I am listing all other species as *Neoschöngastia* until they are properly sorted out. Indeed, I believe that such a course is inevitable in the present state of our knowledge of the Asian and Australasian species, very few of which could at the present time be allotted with accuracy to those other genera.

## NEOSCHÖNGASTIA INDICA (Hirst, 1915) GATER, 1932.

HIRST, S., 1915: *Bull. Ent. Res.*, vi, iii, 183; GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Schöngastia indica* Hirst, 1915b. WALCH, 1927; FINNEGAN, 1945.

*Trombicula muris* WALCH, 1923, 1924a, 1927. FLETCHER *et al.*, 1928; HAYAKAWA & HOKARI, 1947.

*Trombicula muris* WALCH, 1922. WOMERSLEY & HEASLIP, 1943.

*Trombicula indica* (*muris*) PATTON & EVANS, 1929.

*Neoschöngastia indica* GATER, 1932. GUNTER, 1941c; HEASLIP, 1941; RADFORD, 1942, 1946b; WOMERSLEY & HEASLIP, 1943; BLAKE *et al.*, 1945a; HAYAKAWA TANAKA *et al.*, FINNEGAN, 1945; WHARTON & CARVER, PHILIP *et al.*, WOODWARD *et al.*, 1946; THOR & WILLMANN, MOHR, HAYAKAWA & HOKARI, 1947.

*Neoschöngastia muris* (Walch, 1923). Radford, 1942.

*Ascoshöngastia indica* Ewing, 1946b. Wharton, 1946b; Philip & Woodward, 1946b; Sayers *et al.*, Griffiths, 1947.

*Euschöngastia indica* Traub, 1949. Traub *et al.*, Philip & Traub, Audy & Harrison, 1950.

*Neoschöngastia cockingsi* Radford, 1946c.

*Ascoshöngastia cockingsi* Ewing, 1946b. Sayers *et al.*, 1947.

(non) *Microtrombidium muris* Oudemans, 1912b.

Types, Adult, Nymph & Larva: British Museum.

Paratypes, Adult: U.S. National Museum. Larvae: Molteno Institute, U.S. National Museum, South Australian Museum, Coll. Radford.

Sumatra: Rats (*R. diardi*, *R. jalorensis*).

Celebes: Rats.

Malaya: Rats (*R. jalorensis*, *R. concolor*, *R. vociferans*, *R. malaisia*).

Bengal: Mouse (*Nesokia bengalensis*).

Ceylon: *R. kandianus*.

Maldives Is.: *R. norvegicus*.

Burma.

Philippine Is.: Rats (*R. mindanensis*, *R. calcis*, *R. alexandrinus*, *R. norvegicus*).

Guam: *Rattus* sp.

Queensland: Rats and bandicoots.

#### NEOSCHÖNGASTIA SALMI (Oudemans, 1922) Gunther, 1941.

OUDEMANS, A. C., 1922: *Ent. Ber. Ned. Ent. Ver.*, vi, exxvi, 81; GUNTHER, C. E. M., 1941: *Proc. Linn. Soc. N.S.W.*, lxvi, v/vi, 391.

*Schöngastia salmi* Oudemans, 1922. Salm, 1923.

*Schöngastia* (*Trombicula*) *salmi* Walch, 1927.

*Neoschöngastia salmi* Gunther, 1941c.

*Schöngastia salmi* (*incertae sedis*) Womersley, 1944.

Type, Larva.

Java: (Host not specified.)

#### NEOSCHÖNGASTIA GALLINARUM (?) (Hatori, 1920) Sugimoto, 1936.

HATORI, J., 1920: *Taiwan Igaku Zasshi*, No. 209, 317; SUGIMOTO, M., 1936: *J. Jap. Soc. Vet. Sci.*, xv, i, 201.

*Trombicula* (?) *gallinarum* Hatori, 1920 (? nom. nud.).

*Trombicula gallinarum* Hatori, 1919 (?). KAWAMURA & YAMAGUCHI, 1921; Walch, 1923, 1924a, 1925; Kawamura, 1926; Fletcher *et al.*, 1928; Patton & Evans, 1929.

*Trombicula gallinarum* Kawamura & Yamaguchi. Womersley & Heaslip, 1943.

*Neoschöngastia gallinarum* (Hatori, 1920). Sugimoto, 1936a, 1936b, 1938; Radford, 1942, 1946b.

*Neoschöngastia gallinarum* (Kawamura & Yamaguchi, 1921). Ewing, 1946a; Philip & Woodward, 1946b; Wharton & Hardcastle, 1946.

*Paraschöngastia gallinarum* (Kawamura & Yamaguchi, 1921). Womersley & Heaslip, 1943.

Types, Nymph & larva: Taihoku University Museum.

Formosa: Crow (*Corvus colonorum*), pheasant (*Centropus lignator*), *Alcedo japonica*, *Gallus gallus*, sparrow (*Passer tiwanensis*), *Caprimulgus monticola*.

Malaya: *G. gallus*.

#### NEOSCHÖNGASTIA GLOBULARE (Walch, 1927) Gunther, 1941.

WALCH, E. W., 1927: *Geneesk. Tijdschr. v. Ned.-Ind.*, lxvii, 922; GUNTHER, C. E. M., 1941; *Proc. Linn. Soc. N.S.W.*, lxvi, v/vi, 391.

*Trombiculum* (*Trombicula* ?) *globulare* Walch, 1927.

"*Trombiculum globulare*" Gater, 1932.

*Neoschöngastia globulare* Gunther, 1941c. Womersley & Heaslip, 1943.

Type, Larva.

Celebes: Rat.

## NEOSCHÖNGASTIA ANTIPODIANUM (Hirst, 1929) Gunther, 1939.

HIRST, S., 1929: *Proc. Zool. Soc. Lond.*, ii, 165; GUNTHER, C. E. M., 1939: *PROC. LINN. SOC. N.S.W.*, Ixiv, i/ii, 73.

*Schöngastia antipodianum* Hirst, 1929b. Womersley, 1934, 1937; Radford, 1942.

*Neoschöngastia antipodianum* Gunther, 1939a. Womersley, 1939; Womersley & Heaslip, 1943.

Type, *Larva*: British Museum.

Kangaroo I., S. Australia: *R. greyii*.

## NEOSCHÖNGASTIA COORONGENSE (Hirst, 1929) Gunther, 1939.

HIRST, S., 1929: *Ann. Mag. Nat. Hist.*, x, iii, 564; GUNTHER, C. E. M., 1939: *PROC. LINN. SOC. N.S.W.*, Ixiv, i/ii, 73.

*Schöngastia coorongense* Hirst, 1929a, 1929c, 1929d. Womersley, 1934; Radford, 1942.

*Schöngastia coorongensis* Womersley, 1937 (*laps. cal.*).

*Neoschöngastia coorongense* Gunther, 1939a. Womersley, 1939; Heaslip, 1941; Womersley & Heaslip, 1943.

*Ascoschöngastia coorongense* Philip, 1947c. Womersley & Kohls, 1947.

Type, *Larva*: British Museum.

Paratype, *Larva*: South Australian Museum.

Australia: Rats and bandicoots.

## NEOSCHÖNGASTIA DASYCERCII (Hirst, 1929) Gunther, 1939.

HIRST, S., 1929: *Proc. Zool. Soc. Lond.*, ii, 165; GUNTHER, C. E. M., 1939: *PROC. LINN. SOC. N.S.W.*, Ixiv, i/ii, 73.

*Schöngastia dasycerci* Hirst, 1929b. Womersley, 1934, 1937; Radford, 1942.

*Neoschöngastia dasycerci* Gunther, 1939a. Womersley, 1939; Womersley & Heaslip, 1943.

Type, *Larva*: British Museum.

Paratype, *Larva*: South Australian Museum.

S. Australia: Marsupial mouse (*Dasyurus cristicauda*).

## NEOSCHÖNGASTIA (?) DEBILIS Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Neoschöngastia debilis* Gater, 1932. Radford, 1942; Womersley & Heaslip, 1943.

In the absence of sensillae, the placing of this species is provisional.

Type, *Larva*: British Museum.

Malaya: *R. crenoriventer*.

## NEOSCHÖNGASTIA LACUNOSA Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Neoschöngastia lacunosa* Gater, 1932. Radford, 1942; Womersley & Heaslip, 1943.

*Euschöngastia lacunosa* Audy & Harrison, 1950.

Type, *Larva*: British Museum.

Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.

Malaya: *R. vociferans*.

## NEOSCHÖNGASTIA MUTABILIS Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Neoschöngastia mutabilis* Gater, 1932. Gunther, 1939a; Radford, 1942; Womersley & Heaslip, 1943.

*Ascoschöngastia mutabilis* Ewing, 1946b. Audy, Sayers *et al.*, 1947.

Type, *Larva*: British Museum.

Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.

Malaya: *R. vociferans*.

Burma: *R. brunnesculus*, shrew (*Tupaia belangeri*).

## NEOSCHÖNGASTIA PETROGALE (Womersley, 1934) Gunther, 1939.

WOMERSLEY, H., 1934: *Rec. S. Aust. Mus.*, v, ii, 179; GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., lxiv, i/ii, 73.

*Schöngastia petrogale* Womersley, 1934, 1937. Radford, 1942.

*Neoschöngastia petrogale* Gunther, 1939a. Womersley, 1939; Heaslip, 1941; Womersley & Heaslip, 1943.

Type, *Larva*: South Australian Museum.

S. Australia: Wallaby (*Macropus* sp.).

## NEOSCHÖNGASTIA WESTRALIENSE (Womersley, 1934) Gunther, 1939.

WOMERSLEY, H., 1934: *Rec. S. Aust. Mus.*, v, ii, 179; GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., lxiv, i/ii, 73.

*Schöngastia westraliense* Womersley, 1934, 1937. Radford, 1942.

*Neoschöngastia westraliense* Gunther, 1939a. Womersley, 1939; Heaslip, 1941.

*Neoschöngastia westraliensis* Womersley & Heaslip, 1943 (*laps. cal.*).

Type, *Larva*: South Australian Museum.

Queensland: Rats and bandicoots.

## NEOSCHÖNGASTIA BACKHOUSEI Gunther, 1939.

GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., lxiv, i/ii, 73.

*Neoschöngastia fournieri* Gunther, 1938 (*nom. nud.*).

*Neoschöngastia backhousei* Gunther, 1939a, 1942. Wharton & Hardecastle, 1946.

*Paraschöngastia megapodius* Womersley, 1939 (*laps. mem.*). Womersley & Heaslip, 1943; Wharton & Hardecastle, 1946.

*Paraschöngastia backhousei* Gunther, 1940a, 1940d, 1941c.

*Neoschöngastia backhouxi* Radford, 1942 (*laps. cal.*).

Type, *Larva*: School Public Health-Tropical Medicine, Univ. Syd.

Paratype, *Larva*: Australian Museum.

New Guinea: Bush fowl (*Megapodus reinwardt*).

## NEOSCHÖNGASTIA DUBIA Gunther, 1939.

GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., lxiv, i/ii, 73.

*Neoschöngastia incerta* Gunther, 1938 (*nom. nud.*).

*Neoschöngastia dubia* Gunther, 1939a, 1942. Radford, 1942; Wharton & Hardecastle, 1946.

*Paraschöngastia dubia* Womersley, 1939. Gunther, 1940a, 1940d; Womersley & Heaslip, 1943; Kohls *et al.*, 1945.

Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

New Guinea: Bush fowl (*Megapodus reinwardt*), free.

NOTE.—The absence of sensillae was the reason for calling this species *dubia*; later specimens collected had clavate sensillae, and the genus is no longer in doubt.

## NEOSCHÖNGASTIA EDWARDSI Gunther, 1939.

GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., lxiv, i/ii, 73.

*Neoschöngastia rivo* Gunther, 1938 (*nom. nud.*).

*Neoschöngastia edwardsi* Gunther, 1939a, 1940d, 1942. Womersley, 1939; Radford, 1942; Womersley & Heaslip, 1943; Finnegan, 1945.

Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

New Guinea: Bush fowl (*Megapodus reinwardt*), bandicoot (*Echymipera cockerelli*).

## NEOSCHÖNGASTIA IMPAR Gunther, 1939.

GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., lxiv, i/ii, 73.

*Neoschöngastia clauda* Gunther, 1938 (*nom. nud.*).

*Neoschöngastia impar* Gunther, 1939a, 1940a, 1940b, 1940d, 1941c, 1942. Womersley, 1939; Radford, 1942, 1946b; Womersley & Heaslip, 1943; Blake *et al.*, 1945a; Kohls *et al.*, Finnegan, 1945; Mohr, 1947.

*Ascoshöngastia impar* Griffiths, 1947.

*Neoschöngastia bodensis* Gunther, 1940b. Womersley & Heaslip, 1943; Finnegan, 1945.  
Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

Paratypes, *Larvae*: British Mus., Australian Mus., S. Australian Mus., Natal Mus., P.H.D., Entebbe.

New Guinea: Rats (*R. brownii*, *R. practor*, *R. ringens*, *M. moncktoni*, *M. stalkeri*, *M. rubex*), bandicoots (*E. cockerelli*, *P. raffrayana*), rat.

British North Borneo: Mouse-deer (*Tragulus borneanus*).

#### NEOSCHÖNGASTIA LORIUS Gunther, 1939.

GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., Ixiv, i/ii, 73.

*Neoschöngastia jimungi* Gunther, 1938 (*nom. nud.*).

*Neoschöngastia lorius* Gunther, 1939a, 1940d, 1942. Womersley, 1939; Radford, 1942;  
Womersley & Heaslip, 1943.

Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

Paratype, *Larva*: Australian Museum.

New Guinea: Lory (*Lorius roratus*).

#### NEOSCHÖNGASTIA RETROCINCTA Gunther, 1939.

GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., Ixiv, i/ii, 73.

*Neoschöngastia retrocoronata* Gunther, 1938 (*nom. nud.*).

*Neoschöngastia retrocincta* Gunther, 1939a, 1942. Radford, 1942; Wharton & Hardcastle, 1946.

*Paraschöngastia retrocincta* Womersley, 1939. Gunther, 1940a, 1940d; Womersley & Heaslip, 1943.

Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

Paratypes, *Larvae*: Australian Mus., S. Australian Mus.

New Guinea: Bush fowl (*Megapodius reinwardt*).

#### NEOSCHÖNGASTIA YEOMANSI Gunther, 1939.

GUNTHER, C. E. M., 1939: PROC. LINN. SOC. N.S.W., Ixiv, i/ii, 73.

*Neoschöngastia jamesi* Gunther, 1938 (*nom. nud.*).

*Neoschöngastia yeomansi* Gunther, 1939a, 1942. Radford, 1942; Ewing, 1946b; Wharton & Hardcastle, 1946.

*Paraschöngastia yeomansi* Womersley, 1939. Gunther, 1940a, 1940d; Womersley & Heaslip, 1943.

Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

Paratypes, *Larvae*: British Mus., Australian Mus., S. Australian Mus., Rocky Mountain Lab., Natal Mus., P.H.D., Entebbe, Coll. Costa, Coll. Radford.

New Guinea: Bush fowl (*Megapodius reinwardt*).

Palau Is.: *Gallus gallus*, *Megapodius laperouse*.

#### NEOSCHÖNGASTIA DERRICKI Womersley, 1939.

WOMERSLEY, H., 1939: TRANS. ROY. SOC. S. AUST., Ixiii, ii, 149.

*Neoschöngastia derricki* Womersley, 1939. Heaslip, 1941; Womersley & Heaslip, 1943.

Type, *Larva*: South Australian Museum.

Queensland: *R. lutreolus*, *R. assimilis*, rats and bandicoots.

#### NEOSCHÖNGASTIA PERAMELES Womersley, 1939.

WOMERSLEY, H., 1939: TRANS. ROY. SOC. S. AUST., Ixiii, ii, 149.

*Neoschöngastia isoodon* Derrick et al., 1939 (*nom. nud.*). Womersley, 1939.

*Neoschöngastia perameles* Womersley, 1939. Heaslip, 1941; Womersley & Heaslip, 1943; Fenner, 1946.

Type, *Larva*: South Australian Museum.

Queensland: Bandicoots (*Isoodon torosus*, *I. obesulus*).

## NEOSCHÖNGASTIA QUEENSLANDICA Womersley, 1939.

WOMERSLEY, H., 1939: *Trans. Roy. Soc. S. Aust.*, Ixiii, ii, 149.  
*Neoschöngastia queenslandica* Womersley, 1939. Heaslip, 1941; Womersley & Heaslip, 1943.  
 Type, *Larva*: South Australian Museum.  
 Queensland: Rats (*R. assimilis*, *R. youngi*, *R. lutreolus*, *Melomys cervinipes*).

## NEOSCHÖNGASTIA SMITHI Womersley, 1939.

WOMERSLEY, H., 1939: *Trans. Roy. Soc. S. Aust.*, Ixiii, ii, 149.  
*Neoschöngastia smithi* Womersley, 1939. Heaslip, 1941; Womersley & Heaslip, 1943.  
 Type, *Larva*: South Australian Museum.  
 Queensland: *R. assimilis*.

## NEOSCHÖNGASTIA TRICHOSURI (Womersley, 1939), Womersley &amp; Heaslip, 1943.

WOMERSLEY, H., 1939: *Trans. Roy. Soc. S. Aust.*, Ixiii, ii, 149; WOMERSLEY, H., & HEASLIP, W. G., 1943: *Ibid.*, Ixvii, i, 68.  
*Neoschöngastia westraliense* Hirst (*laps. cal*) var. *trichosuri* Womersley, 1939.  
*Neoschöngastia westraliense* v. *trichosuri* Womersley, 1939: Womersley & Heaslip, 1943.  
*Neoschöngastia trichosuri* Womersley & Heaslip, 1943.

Type, *Larva*: South Australian Museum.

Queensland: Possum (*Trichosurus vulpecula*).

## NEOSCHÖNGASTIA FOLIATA Gunther, 1940.

GUNTHER, C. E. M., 1940: *Proc. Linn. Soc. N.S.W.*, Ixv, iii/iv, 250.  
*Neoschöngastia foliata* Gunther, 1940a, 1940d. Womersley & Heaslip, 1943.  
*Ascoschöngastia foliata* Womersley & Kohls, 1947.

Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

Paratypes, *Larvae*: British Mus., Australian Mus., S. Australian Museum.

New Guinea: Wallaby (*Macropus coxeni*).

## NEOSCHÖNGASTIA WOMERSLEYI Gunther, 1940.

GUNTHER, C. E. M., 1940: *Proc. Linn. Soc. N.S.W.*, Ixv, iii/iv, 250.  
*Neoschöngastia womersleyi* Gunther, 1940a, 1940d. Womersley & Heaslip, 1943; Blake et al., 1945a; Radford, 1946b.  
 Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.  
 Paratypes, *Larvae*: British Museum, Australian Museum.  
 New Guinea: Wallaby (*Macropus coxeni*), rats (*R. browni*, *R. mordax*, *R. praetor*), bandicoot (*Echymipera cockerelli*).

## NEOSCHÖNGASTIA (?) SHIELDSI Gunther, 1941.

GUNTHER, C. E. M., 1941: *Proc. Linn. Soc. N.S.W.*, Ixvi, iii/iv, 157.  
*Neoschöngastia shieldsi* Gunther, 1941b. Womersley & Heaslip, 1943.  
 In the absence of sensillae, the placing here adopted is provisional.  
 Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.  
 Paratypes, *Larvae*: British Museum, Australian Museum.  
 New Guinea: Rat (*Melomys rubex*).

## NEOSCHÖNGASTIA CAIRNSENSIS Womersley &amp; Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, Ixvii, i, 68.  
*Neoschöngastia cairnsensis* Womersley & Heaslip, 1943. Fenner, McCulloch, 1946.  
*Neoschöngastia cairnsensis* var. *gateri* Womersley & Heaslip, 1943.  
 Type, *Larva*: South Australian Museum.  
 Queensland: Rats (*R. youngi*, *R. lutreolus*, *R. assimilis*), bandicoots (*Isoodon torosus*, *I. obesulus*, *Perameles nasuta*), *Uromys sherrini*, *Melomys cervinipes*.

## NEOSCHÖNGASTIA (GUNTHERI) (Womersley &amp; Heaslip, 1943).

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, Ixvii, i, 68.  
*Neoschöngastia guntheri* Womersley & Heaslip, 1943 (nom. praeocc.). Fenner, 1946.  
 (non) *Neoschöngastia guntheri* Radford, 1942.

I have written to Mr. Womersley about the specific name of this species, and as it is his privilege to select a new name, I am leaving it listed as above in the meantime.

Type, *Larva*: South Australian Museum.

Queensland: Rats, *Hydromys longmani*.

**NEOSCHÖNGASTIA HEASLIPI** Womersley & Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.

*Neoschöngastia heaslipi* Womersley & Heaslip, 1943.

Type, *Larva*: South Australian Museum.

Queensland: Rats.

**NEOSCHÖNGASTIA (?) HIRSTI** Womersley & Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.

*Neoschöngastia hirsti* Womersley & Heaslip, 1943. McCulloch, Fenner, 1946.

In the absence of sensillae the placing of this species is regarded as provisional.

Type, *Larva*: South Australian Museum.

Queensland: *Uromys sherrini*, *Melomys cervinipes*, possum (*Trichosurus vulpecula*), bandicoot (*Isoodon obesulus*), rats.

**NEOSCHÖNGASTIA INNISFAILENSIS** Womersley & Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.

*Neoschöngastia innisfailensis* Womersley & Heaslip, 1943.

*Ascoschöngastia innisfailensis* Philip, 1947c. Womersley & Kohls, 1947.

Type, *Larva*: South Australian Museum.

Queensland: *Melomys littoralis*.

**NEOSCHÖNGASTIA MELOMYS** Womersley & Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.

*Neoschöngastia melomys* Womersley & Heaslip, 1943. McCulloch, 1944.

Type, *Larva*: South Australian Museum.

Queensland: *Melomys littoralis*.

**NEOSCHÖNGASTIA PHASCOGALE** Womersley & Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.

*Neoschöngastia phascogale* Womersley & Heaslip, 1943.

Type, *Larva*: South Australian Museum.

Queensland: *Phascogale* sp., bandicoots (*Isoodon torosus*, *Perameles nasuta*).

**NEOSCHÖNGASTIA RATTUS** Womersley & Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.

*Neoschöngastia rattus* Womersley & Heaslip, 1943. Mohr, 1947.

Type, *Larva*: South Australian Museum.

Queensland: *R. assimilis*.

New Guinea: Rats.

**NEOSCHÖNGASTIA SIMILIS** Womersley & Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.

*Neoschöngastia similis* Womersley & Heaslip, 1943.

Type, *Larva*: South Australian Museum.

Queensland: Rats.

**NEOSCHÖNGASTIA MCCULLOCHI** Womersley, 1944.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, lxviii, i, 82.

*Neoschöngastia mccullochi* Womersley, 1944.

*Ascoschöngastia mccullochi* Womersley & Kohls, 1947.

Type, *Larva*: South Australian Museum.

New Guinea: Free.

- NEOSCHÖNGASTIA SOEKABOEMIENSIS (Takekawa, 1945) Hayakawa & Hokari, 1947.  
 TAKEKAWA, S., 1945: *Nampogun Boekikyusui Bu*, cxxvi; HAYAKAWA, K., & HOKARI, K., 1947: A Comparative Study of Japanese & Tropical Tsutsugamushi Diseases, Tokyo. *Trombicula soekaboemensis* Takekawa, 1945.
- Neoschöngastia soekaboemensis* Hayakawa & Hokari, 1947.
- Type, *Larva*.  
 Java.
- NEOSCHÖNGASTIA LANIUS Radford, 1946.  
 RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.
- Neoschöngastia lanius* Radford, 1946c.
- Ascoschöngastia lanius* Sayers et al., 1947.
- Type, *Larva*: British Museum.  
 Manipur: Shrike (*Lanius nasutus*).
- NEOSCHÖNGASTIA MANIPURENSIS Radford, 1946.  
 RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.
- Neoschöngastia manipurensis* Radford, 1946c.
- Ascoschöngastia manipurensis* Sayers et al., 1947.
- Type, *Larva*: British Museum.  
 Manipur: *R. rufescens*.
- NEOSCHÖNGASTIA THOMASI (Radford, 1946) Sayers et al., 1947.  
 RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247; SAYERS, M. H. P., et al., 1947: Report of Scrub Typhus Res. Lab., War Office.  
*Paraschöngastia thomasi* Radford, 1946c.  
*Neoschöngastia thomasi* Sayers et al., 1947.
- Type, *Larva*: British Museum.  
 Manipur: Shrike (*Lanius nasutus*).
- NEOSCHÖNGASTIA KOHLSI Philip & Woodward, 1946.  
 PHILIP, C. B., & WOODWARD, T. E., 1946: *Amer. J. Trop. Med.*, xxvi, ii, 157.
- Neoschöngastia kohlsi* Philip & Woodward, 1946a. Philip et al., 1946.  
*Ascoschöngastia kohlsi* Philip & Woodward, 1946b. Ewing, 1946b; Audy, Sayers et al., 1947.
- Holotype, *Larva*: U.S. National Museum.  
 Paratypes, *Larvae*: U.S. National Mus., S. Australian Mus., Rocky Mountain Lab., Coll. Philip, Coll. Woodward.  
 Philippine Is.: Rats (*R. mindanensis*, *R. vigoratus*).
- NEOSCHÖNGASTIA PHILIPPENSIS Philip & Woodward, 1946.  
 PHILIP, C. B., and WOODWARD, T. E., 1946: *Amer. J. Trop. Med.*, xxvi, ii, 157.
- Neoschöngastia philippensis* Philip & Woodward, 1946a. Philip et al., 1946.  
*Ascoschöngastia philippensis* Philip & Woodward, 1946b.
- Holotype, *Larva*: U.S. National Museum.  
 Paratypes, *Larvae*: U.S. National Mus., S. Australian Mus., Rocky Mountain Lab., Coll. Philip, Coll. Woodward.  
 Philippine Is.: Rats (*R. mindanensis*, *R. vigoratus*, *R. alexandrinus*).
- NEOSCHÖNGASTIA ATOLLENSIS Wharton & Hardcastle, 1946.  
 WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.
- Neoschöngastia atollensis* Wharton & Hardcastle, 1946.
- Type, *Larva*: U.S. National Museum.  
 Okinawa, Ulithi: *Numenius phaeopus*. birds.
- NEOSCHÖNGASTIA BOUGAINVILLENSIS Wharton & Hardcastle, 1946.  
 WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.
- Neoschöngastia bougainvillensis* Wharton & Hardcastle, 1946.
- Type, *Larva*: U.S. National Museum.  
 Bougainville Is.: *H. tahitica*.  
 Guam: Noddy (*Anous stolidus*), tattler (*Heteroscelus incanus*).

## NEOSCHÖNGASTIA CARVERI Wharton &amp; Hardcastle, 1946.

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.  
*Neoschöngastia carveri* Wharton & Hardcastle, 1946.

Type, Larva: U.S. National Museum. *Nymph*: U.S. National Museum.  
 Paratypes, Coll. Radford.

Guam: *Numenius phaeopus*, *Demigretta sacra*, *Pluvialis dominica*, *Arenaria interpres*.

Okinawa: *Gygis alba*, *Sterna douglasii*, *Monticola solitarius*.

Ulithi: Plover (*Pluvialis dominica*).

Peleliu Is.: Tattler (*Heteroscelus incanus*).

## NEOSCHÖNGASTIA EGRETTA Wharton &amp; Hardcastle, 1946.

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.  
*Neoschöngastia egretta* Wharton & Hardcastle, 1946.

Type, Larva: U.S. National Museum.

Okinawa: Egret (*Egretta intermedia*).

Ulithi: Egrets (*Egretta intermedia*, *Demigretta sacra*), noddy (*Anous stolidus*),  
 plover (*Pluvialis dominica*).

## NEOSCHÖNGASTIA EWINGI Wharton &amp; Hardcastle, 1946.

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.  
*Neoschöngastia ewingi* Wharton & Hardcastle, 1946.

Type, Larva: U.S. National Museum.

Ulithi: Egret (*Egretta intermedia*), *Pluvialis dominica*, *Gallus gallus*.

Palau & Peleliu: *Gallus gallus*.

Guam: *Heteroscelus incanus*.

## NEOSCHÖNGASTIA MONTICOLA Wharton &amp; Hardcastle, 1946.

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.  
*Neoschöngastia monticola* Wharton & Hardcastle, 1946.

Type, Larva: U.S. National Museum.

Paratype, Coll. Radford.

Okinawa: *Monticola solitarius*, birds.

## NEOSCHÖNGASTIA NAMRUI Wharton &amp; Hardcastle, 1946.

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.  
*Neoschöngastia namrui* Wharton & Hardcastle, 1946.

Type, Larva: U.S. National Museum.

Paratype, Coll. Radford.

Guam: *Numenius phaeopus*, *Heteroscelus incanus*, *Pluvialis dominica*.

Okinawa: *Gygis alba*.

Ulithi: Shore birds.

## NEOSCHÖNGASTIA PAUENSIS Wharton &amp; Hardcastle, 1946.

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.  
*Neoschöngastia pauensis* Wharton & Hardcastle, 1946.

Type, Larva: U.S. National Museum.

Paratype, Coll. Radford.

Ulithi: Plover (*Pluvialis dominica*).

## NEOSCHÖNGASTIA POSEKANYI Wharton &amp; Hardcastle, 1946.

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.  
*Neoschöngastia posekanyi* Wharton & Hardcastle, 1946.

Type, Larva: U.S. National Museum.

Paratype, Coll. Radford.

Okinawa: *Monticola solitarius*, *Streptopelia orientalis*.

## NEOSCHÖNGASTIA RIVERSI Wharton &amp; Hardcastle, 1946.

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.*Neoschöngastia riversi* Wharton & Hardcastle, 1946.Type, *Larva*: U.S. National Museum.

Paratype, Coll. Radford.

Bougainville: *Eurystomus orientalis*, *Haliaeetus sanfordi*, *Falco severus*.Philippine Is.: *Haleyon chloris*, *Eurystomus orientalis*.

## NEOSCHÖNGASTIA SOLOMONIS (Wharton &amp; Hardeastle, 1946).

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.*Neoschöngastia americana solomonis* Wharton & Hardcastle, 1946. Wharton, 1946b.Type, *Larva*: U.S. National Museum.

Paratype, Coll. Radford.

Bougainville: *Hirundo tahitica*.Guam: *Anous stolidus*.Iwo Jima: *Monticola solitarius*.Okinawa: *Monticola solitarius*, *Streptopelia orientalis*, *Butorides striatus*, birds.

## NEOSCHÖNGASTIA STRONGI Wharton &amp; Hardcastle, 1946.

WHARTON, G. W., & HARDCastle, A. B., 1946: *J. Parasit.*, xxxii, iii, 286.*Neoschöngastia strongi* Wharton & Hardcastle, 1946.Type, *Larva*: U.S. National Museum.Guam: *Numenius phaeopus*. Peleliu: *Arenaria interpres*.

## NEOSCHÖNGASTIA BUSHLANDI (Philip, 1947).

PHILIP, C. B., 1947: *J. Parasit.*, xxxiii, v, 387.*Ascoschöngastia bushlandi* Philip, 1947c.Holotype, *Larva*: U.S. National Museum.Paratypes, *Larvae*: U.S. National Mus., British Mus., S. Australian Mus., Rocky Mountain Lab., Coll. Wharton, Coll. Philip, Coll. Bushland.Owi Is., N.G.: Bush turkey (*Megapodius* sp.).

## NEOSCHÖNGASTIA ECHYMPERA (Womersley &amp; Kohls, 1947).

WOMERSLEY, H., & KOHLS, G. M., 1947: *Trans. Roy. Soc. S. Aust.*, lxxi, i, 3.*Ascoschöngastia echymipera* Womersley & Kohls, 1947.Type, *Larva*: South Australian Museum.Paratypes, *Larvae*: S. Australian Mus., British Mus., U.S. National Mus., Rocky Mountain Lab.New Guinea: Bandicoot (*Echymipera cockerelli*).

## NEOSCHÖNGASTIA UROMYS (Womersley &amp; Kohls, 1947).

WOMERSLEY, H., & KOHLS, G. M., 1947: *Trans. Roy. Soc. S. Aust.*, lxxi, i, 3.*Ascoschöngastia uromys* Womersley & Kohls, 1947.Type, *Larva*: South Australian Museum.Paratypes, *Larvae*: S. Australian Mus., U.S. National Mus., British Mus., Rocky Mountain Lab.New Guinea: *Uromys lamingtonensis*.

## NEOSCHÖNGASTIA MASTA (Traub &amp; Sundermeyer, 1950).

TRAUB, R., & SUNDERMEYER, E. W., 1950: *Proc. Helminth. Soc. Wash.*, xvii, i, 35.*Ascoschöngastia masta* Traub & Sundermeyer, 1950.Cotypes, *Larvae*: U.S. National Museum, Rocky Mountain Lab., British Mus., S. Australian Mus.Burma: *R. rattus*, shrews (*Tupaia belangeri*, *Crocidura* sp.).NOTE.—There is a misidentification (*Neoschöngastia minor* Bull. U.S. Army Med. Dept., 1944) which confuses this specific name for this genus.

## PART XV.

## Genus ASCOSCHÖNGASTIA Ewing, 1946.

EWING, H. E., 1946: *Proc. Biol. Soc. Wash.*, lix, 69.

*Neoschöngastia* EWING, 1929 (*partim*). Ewing, 1946b.

*Ascoschöngastia* EWING, 1946b. Philip & Woodward, 1946b; Radford, 1946c; Wharton, 1946b, 1947c; Sayers *et al.*, Griffiths, Womersley & Kohls, Audy, 1947; Philip, 1947c; Traub & Sundermeyer, Audy & Harrison, 1950; WHARTON *et al.*, 1951.

Genotype, *Ascoschöngastia malayensis* (Gater, 1932) Ewing, 1946.

As *A. malayensis* has a special feature not shared by the many species labelled *Ascoschöngastia* in recent years, and as in any case it is not possible to assign many of the Asian and Australasian species correctly to this genus, I have left all the other similar species in *Neoschöngastia* until they can be properly sorted out.

## ASCOSCHÖNGASTIA MALAYENSIS (Gater, 1932) Ewing, 1946.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143; EWING, H. E., 1946: *loc. cit. supra*.

*Neoschöngastia malayensis* Gater, 1932. Radford, 1942; Womersley & Heaslip, 1943.

*Trombicula malayensis* Hayakawa Tanaka *et al.*, 1945; Hayakawa & Hokari, 1947.

*Ascoschöngastia malayensis* Ewing, 1946b. Audy & Harrison, Traub & Sundermeyer, 1950; WHARTON *et al.*, 1951.

Type, Larva: British Museum.

Paratype, Larva: U.S. National Museum.

Malaya: *R. malaisia*.

## PART XVI.

## Genus MYOTROMBICULA Womersley &amp; Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68.

*Myotrombicula* Womersley & Heaslip, 1943. Ewing, 1944b, 1946a; Lawrence, 1929; WHARTON *et al.*, 1951.

Genotype, *Myotrombicula vespertilionis* Womersley & Heaslip, 1943.

## MYOTROMBICULA VESPERTILIONIS Womersley &amp; Heaslip, 1943.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *loc. cit. supra*.

*Myotrombicula vespertilionis* Womersley & Heaslip, 1943. Fischbach & Howell, 1945; Wharton *et al.*, 1951.

The shape of the sensillae of this species is unknown.

Type, Larva: South Australian Museum.

South Australia (?): ? bats.

## PART XVII.

## Genus OENOSCHÖNGASTIA Womersley &amp; Kohls, 1947.

WOMERSLEY, H., & KOHLS, G. M., 1947: *Trans. Roy. Soc. S. Aust.*, lxxi, i, 3.

*Oenoschöngastia* Womersley & Kohls, 1947. WHARTON *et al.*, 1951.

Genotype, *Oenoschöngastia cana* Womersley & Kohls, 1947.

## OENOSCHÖNGASTIA CANA Womersley &amp; Kohls, 1947.

WOMERSLEY, H., & KOHLS, G. M., 1947: *loc. cit. supra*.

*Oenoschöngastia cana* Womersley & Kohls, 1947. Wharton *et al.*, 1951.

Type, Larva: South Australian Museum.

Paratypes, Larvae: South Australian Museum, Rocky Mountain Laboratory, U.S. National Museum, British Museum, Coll. Radford.

New Guinea: Free (mound of brush turkey).

## PART XVIII.

## Genus HEASLIPIA (Womersley &amp; Heaslip, 1943) Ewing, 1944.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, lxvii, i, 68;

EWING, H. E., 1944: *Proc. Biol. Soc. Wash.*, lvii, 101.

*Trombiculoides* Womersley & Heaslip, 1943 (*nom. praeocc.*: *non* *Trombiculoides* Jacot, 1938). Ewing, 1944a.

*Heaslipia* Ewing, 1944a, 1944b, 1946a. Lawrence, 1949; Wharton *et al.*, 1951.

*Heaslipia (Trombiculoides)* Philip *et al.*, 1946. Philip & Woodward, 1946a, 1946b.

Genotype, *Heaslipia gateri* (Womersley & Heaslip, 1943) Ewing, 1944.

#### HEASLIPIA GATERI (Womersley & Heaslip, 1943) Ewing, 1944.

WOMERSLEY, H., & HEASLIP, W. G., 1943: *loc. cit. supra*: EWING, H. E., 1944: *loc. cit. supra*.

*Trombiculoides gateri* Womersley & Heaslip, 1943. Wharton *et al.*, 1951.

*Heaslipia gateri* Ewing, 1944a.

*Heaslipia (Trombiculoides) gateri* Philip *et al.*, 1946. Philip & Woodward, 1946a, 1946b.

Type, Larva: South Australian Museum.

Malaya: *R. argentiventer*.

#### PART XIX.

##### Genus NOVOTROMBICULA Womersley & Kohls, 1947.

WOMERSLEY, H., & KOHLS, G. M., 1947: *Trans. Roy. Soc. S. Aust.*, Ixxi, i, 3.

*Novotrombicula* Womersley & Kohls, 1947. Wharton *et al.*, 1951.

Genotype, *Novotrombicula owiensis* Womersley & Kohls, 1947.

##### NOVOTROMBICULA OWIENSIS Womersley & Kohls, 1947.

WOMERSLEY, H., & KOHLS, G. M., 1947: *loc. cit. supra*.

*Novotrombicula owiensis* Womersley & Kohls, 1947. Wharton *et al.*, 1951.

Type, Larva: South Australian Museum.

Paratypes, Larvae: South Australian Museum, U.S. National Mus.

Owi Is., New Guinea: Free.

#### PART XX.

##### Genus MACKIENA Traub & Evans, 1950.

TRAUB, R., & EVANS, T. M., 1950: *J. Wash. Acad. Sci.*, xl, iv, 126.

*Mackiena* Traub & Evans, 1950a. Wharton *et al.*, 1951.

Genotype, *Mackiena empodiformis* Traub & Evans, 1950.

This genus should most likely be listed as a synonym of *Neoschöngastia* Ewing, 1929, but I am leaving it as distinct for the present.

##### MACKIENA EMPODIFORMIS Traub & Evans, 1950.

TRAUB, R., & EVANS, T. M., 1950: *loc. cit. supra*.

*Mackiena empodiformis* Traub & Evans, 1950a. Wharton *et al.*, 1951.

Holotype, Larva: U.S. National Museum.

Paratype, Larva: British Museum.

Burma: Weaver-finch (*Ploceus pugnans*).

#### PART XXI.

##### Genus TRISETICA Traub & Evans, 1950.

TRAUB, R., & EVANS, T. M., 1950: *J. Parasit.*, xxxvi, iv, 356.

*Trisetica* Traub & Evans, 1950b. Wharton *et al.*, 1951.

Genotype, *Trisetica melvini* Traub & Evans, 1950.

This genus is fairly obviously a synonym of *Tecomatlana* Hoffmann, 1947, but it must be left here for the present.

##### TRISETICA MELVINI Traub & Evans, 1950.

TRAUB, R., & EVANS, T. M., 1950: *loc. cit. supra*.

*Trisetica melvini* Traub & Evans, 1950b. Wharton *et al.*, 1951.

Holotype, Larva: U.S. National Museum.

Paratypes, Larvae: South Australian Museum, Rocky Mountain Lab., Chicago Natural History Museum.

Burma: Free in cave frequented by bats.

## PART XXII.

## Subfamily LEEUWENHOEKINAE Womersley, 1944.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, lxviii, i, 82.  
 Trombiculinae Ewing, 1929 (*partim*).  
*Leeuwenhoekinae* Womersley, 1944. Ewing, 1946a; Wharton, 1947c; Lawrence, 1949;  
 WHARTON *et al.*, 1951.

*Leeuwenhoekinae* Radford, 1946b (*laps. cal.*).

(*non*) *Leeuwenhoekidae* Womersley, 1945. Ewing, 1946a.  
 Type Genus, *Leeuwenhoekia* Oudemans, 1911.

Ewing (1942) split off *Comatacarus* and *Acomatacarus* from *Leeuwenhoekia*, and allied them with *Apolonia*; Womersley in 1944 raised *Leeuwenhoekia* to the status of a subfamily, but recognized only the one genus, *Leeuwenhoekia*. Then, in 1945, Womersley raised his subfamily to the status of a family, and included *Leeuwenhoekia*, *Comatacarus*, *Acomatacarus*, *Hannemania* Oudemans, 1911, and *Apolonia* Torres & Braga, 1939, together with a genus known only from the adult, *Neotrombidium* Leonardi, 1901. Womersley also transferred to *Acomatacarus* four adults previously assigned to other genera.

However, Ewing (1946a) and later authorities refused to agree that the *Leeuwenhoekinae* merited family status, and Wharton (1947c) redefined the subfamily and included the following genera:

*Leeuwenhoekia* Oudemans, 1911 (Type, *Heterothrombidium verduni* Oudemans, 1910).

*Hannemania* Oudemans, 1911 (Type, *Heterothrombidium hylodeus* Oudemans, 1910).

*Odontacarus* Ewing, 1929 (Type, *Trombicula dentata* Ewing, 1925).

*Comatacarus* Ewing, 1942 (Type, *C. americanus* Ewing, 1942).

*Acomatacarus* Ewing, 1942 (Type, *A. arizonensis* Ewing, 1942).

*Whartonia* Ewing, 1944 (Type, *Hannemania nudosetosa* Wharton, 1938).

*Chatia* Brennan, 1946 (Type, *C. setosa* Brennan, 1946).

*Apolonia* was transferred by Wharton to the Apoloniinae.

Finally, Wharton *et al.* (1951) made *Comatacarus* a subgenus of *Leeuwenhoekia* and made three new genera of Lawrence's (1949) into subgenera of *Acomatacarus* (these will be listed here as synonyms, since I am not dealing at present with subgenera).

An interesting point arises following the transfer by Womersley of four adults to *Acomatacarus*. They are one of the four Australian species of *Calothrombium* and three of the four species of *Microtrombidium* (*Dromeothrombium*), which were transferred because they are stated to be congeneric with Philip's nymph of *A. australiensis* and Kohls' nymphs of *A. nova-guinea* and *A. longipes*. Now the genus *Calothrombium* is by Berlese, 1918, and *Dromeothrombium* is a subgenus by Berlese dated 1912—and Article 27 of the International Rules of Zoological Nomenclature states:

"The Law of Priority obtains and consequently the oldest available name is retained:

"(b) When any stage in the life history is named before the animal itself;

"(d) When an animal represents a regular succession of dissimilar generations which have been considered as belonging to different species or even to different genera."

I am, however, deterred from adopting *Dromeothrombium* Berlese, 1912, as the prior name for *Acomatacarus* Ewing, 1942, because Womersley did not transfer all of the available members of the two genera concerned, but only some. This leaves a reasonable suspicion that Womersley's former placings of either the included or the excluded species were wrong, and since some have been left behind one must assume at present that they are still correctly placed and that the others were not.

The only other point is that Radford (1946b) described a new genus, *Womersleyia*, without mentioning how many segments its legs possessed (and so there is no way of deciding in what subfamily it belongs—this is an unfortunate weakness of Wharton *et al.* in their 1951 key); he placed it in the *Leeuwenhoekinae*, where it must stay for the present.

## PART XXIII.

Genus HANNEMANIA Oudemans, 1911.

OUDEMANS, A. C., 1911: *Ent. Ber. Ned. Ent. Ver.*, iii, lviii, 137.

*Heterothrombidium* Verdun, 1909 (*partim*).

*Hannemania* Oudemans, 1911. Ewing, 1929, 1931, 1942, 1944b, 1946a; Thor, 1935, 1936; Fonseca, 1936; Womersley, 1937, 1945; Womersley & Heaslip, 1943; Thor & Willmann, 1947; Lawrence, 1949; WHARTON *et al.*, 1951.

(*non*) *Hannemania* Gunther, 1938.

Genotype, *Hannemania hylodeus* (Oudemans, 1910) Oudemans, 1911.

HANNEMANIA VELLAE Dumbleton, 1946.

DUMBLETON, L. J., 1946: *Trans. Roy. Soc. N.Z.*, lxxvi, iii, 409.

*Hannemania vellae* Dumbleton, 1946.

Type & Paratypes, *Larvae*: South Australian Museum.

Vella Lavella Is., B.S.I.: Bat.

## PART XXIV.

Genus ACOMATACARUS Ewing, 1942 (*sensu lato*).

EWING, H. E., 1942: *J. Parasit.*, xxviii, 485.

*Leeuwenhoekia* Oudemans, 1911 (*partim*). Warburton, 1928; Ewing, 1929; Thor, 1935, 1936; Womersley, 1937, 1944; Gunther, 1939a, 1940d, 1941c, 1942; Womersley & Heaslip, 1943; Thor & Willmann, 1947.

*Acomatacarus* Ewing, 1942. Dumbleton, 1946; Radford, 1946c; Lawrence, Brennan, 1949; WHARTON *et al.*, 1951.

*Hyracarus* Lawrence, 1949.

Subgenus *Hyracarus* (Lawrence, 1949) Wharton *et al.*, 1951.

*Austrombicula* Lawrence, 1949.

Subgenus *Austrombicula* (Lawrence, 1949) Wharton *et al.*, 1951.

*Austracarus* Lawrence, 1949.

Subgenus *Austracarus* (Lawrence, 1949) Wharton *et al.*, 1951.

(*non*) *Trombicula* Berlese, 1905: Roy, 1946.

(*non*) *Hannemania* Oudemans, 1911: Gunther, 1938.

Genotype: *Acomatacarus arizonensis* Ewing, 1942.

ACOMATACARUS AUSTRALIENSIS (Hirst, 1925) Ewing, 1942.

HIRST, S., 1925: *Trans. Roy. Soc. Trop. Med. Hyg.*, xix, iii, 150; EWING, H. E., 1942: loc. cit. supra.

*Leeuwenhoekia australiensis* Hirst, 1925a, 1928. Samson, Walch, 1927; Warburton, 1928; Thor, 1936; Gunther, 1940a, 1940d, 1941c; Heaslip, 1941; Radford, 1942; Finnegan, Gill *et al.*, 1945; Philip & Woodward, 1946b; Thor & Willmann, 1947; Brumpt, 1949.

*Leeuwenhoekia australiensis* (Hirst, 1911). Womersley & Heaslip, 1943.

*Leeuwenhoekia australiense* Womersley, 1934, 1937 (*laps. cal.*). Gunther, 1929a, 1942.

*Trombicula australiensis* Patton & Evans, 1929. Roy, 1946.

*Acomatacarus australiensis* Ewing, 1942. McCulloch, 1946; Fuller, 1947b.

*Acomatacarus (Leeuwenhoekia) australiensis*. *Austral. Agric. Gaz.*, 1946.

*Acomatacarus australiense* McCulloch, 1947 (*laps. cal.*).

*Hannemania blestowei* Gunther, 1938.

Scrub-itch mite Jackson, 1908.

Types, *Larva*: British Museum. *Nymph*: South Australian Museum.

Paratypes, *Larvae*: Australian Museum, S. Australian Mus., School Public Health Trop. Med., Univ. Sydney.

Australia: Man, cat, rats, bandicoots.

New Guinea: Bush turkey (*Tallegalla jobiensis*), bush fowl (*Megapodius reinwardt*), thrushes (*Caleya megarhyncha*, *Eupetes caerulescens*), pigeon (*Chalcophaps stephani*), whistler (*Pachycephala* sp.), cassowary (*Casuarius casuarius*), catbird (*Ailuroedus melanocephalus*), pitta (*Pitta mackloti*), kingfisher (*Tanysiptera galeata*),

bower-bird (*Chlamydera cerviniventris*), *Pitohui kirhocephalus*, birds of paradise (*Paradisaea minor*, *P. raggiana*).

Celebes: Rat.

**ACOMATACARUS NOVA-GUINEA** (Womersley, 1944) Womersley, 1945.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, Ixviii, i, 82; *Idem*, 1945: *Ibid.*, Ixix, i, 96.

*Leeuwenhoekia nova-guinea* Womersley, 1944. Blake *et al.*, 1945a; Radford, 1942.

*Acomatacarus nova-guinea* Womersley, 1945. McCulloch, Dumbleton, 1946.

Type, *Larva & Nymph*: South Australian Museum.

New Guinea: Magpie (*Gymnodactyla* sp.), kingfisher (*Tanysiptera galeata*), free. - Nissan I.: Tree kangaroo.

**ACOMATACARUS ADELAIDEAE** (Womersley, 1944) Womersley, 1945.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, Ixviii, i, 82; *Idem*, 1945: *Ibid.*, Ixix, i, 96.

*Leeuwenhoekia adelaideae* Womersley, 1944. Gill *et al.*, 1945; Fenner, 1946.

*Acomatacarus adelaideae* Womersley, 1945.

Type, *Larva*: South Australian Museum.

Australia: Cat, rats, *Uromys sherrini*, kangaroos (*Macropus major*, *M. rufa*), wild pig, sheep, apostle bird (*Struthidea cinerea*), honeyeater (*Entomyzon cyanotis*).

**ACOMATACARUS HIRSTI** (Womersley, 1944) Womersley, 1945.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, Ixviii, i, 82; *Idem*, 1945: *Ibid.*, Ixix, i, 96.

*Leeuwenhoekia hirsti* Womersley, 1944. McCulloch, 1944.

*Acomatacarus hirsti* Womersley, 1945.

Type, *Larva*: South Australian Museum.

Queensland: Free.

**ACOMATACARUS MCCULLOCHI** (Womersley, 1944) Womersley, 1945.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, Ixviii, i, 82; *Idem*, 1945: *Ibid.*, Ixix, i, 96.

*Leeuwenhoekia mccullochi* Womersley, 1944.

*Acomatacarus mccullochi* Womersley, 1945.

Type, *Larva*: South Australian Museum.

Queensland: Free.

**ACOMATACARUS SOUTHCOTTI** (Womersley, 1944) Womersley, 1945.

WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, Ixviii, i, 82; *Idem*, 1945: *Ibid.*, Ixix, i, 96.

*Leeuwenhoekia southcotti* Womersley, 1944.

*Acomatacarus southcotti* Womersley, 1945.

Type, *Larva*: South Australian Museum.

Northern Territory of Australia: Skink (*Lygosoma* sp.).

**ACOMATACARUS LONGIPES** Womersley, 1945.

WOMERSLEY, H., 1945: *Trans. Roy. Soc. S. Aust.*, Ixix, i, 96.

*Acomatacarus longipes* Womersley, 1945.

Types, *Nymph & Larva*: South Australian Museum.

New Guinea: *Podargus* sp., honeyeater.

**ACOMATACARUS ATHERTONENSIS** Womersley, 1945.

WOMERSLEY, H., 1945: *Trans. Roy. Soc. S. Aust.*, Ixix, i, 96.

*Acomatacarus athertonensis* Womersley, 1945. McCulloch, 1946.

Type, *Larva*: South Australian Museum.

Queensland: Free.

## ACOMATACARUS ECHIDNUS Womersley, 1945.

WOMERSLEY, H., 1945: *Trans. Roy. Soc. S. Aust.*, lxix, i, 96.

*Acomatacarus echidnus* Womersley, 1945.

Type, *Larva*: South Australian Museum.

Queensland: *Echidna* sp.

## ACOMATACARUS BARRINENSIS Womersley, 1945.

WOMERSLEY, H., 1945: *Trans. Roy. Soc. S. Aust.*, lxix, i, 96.

*Acomatacarus barrinensis* Womersley, 1945.

Type, *Larva*: South Australian Museum.

Queensland: Man, free.

## ACOMATACARUS RETENTUS (Banks, 1916) Womersley, 1945.

BANKS, N., 1916: *Trans. Roy. Soc. S. Aust.*, xl, 224; WOMERSLEY, H., 1945: *Ibid.*, lxix, i, 96.

*Rhyncholophus retentus* Banks, 1916.

*Microtrombidium (Enemthrombium [laps. cal.]) retentus* Womersley, 1934.

*Calothrombium retentus* Womersley, 1937.

*Acomatacarus retentus* Womersley, 1945.

Type, *Adult*: South Australian Museum.

Victoria: Free.

## ACOMATACARUS ATTOLUS (Banks, 1916) Womersley, 1945.

BANKS, N., 1916: *Trans. Roy. Soc. S. Aust.*, xl, 224; WOMERSLEY, H., 1945: *Ibid.*, lxix, i, 96.

*Rhyncholophus attolus* Banks, 1916.

*Microtrombidium attolus* Womersley, 1934.

*Microtrombidium (Dromeothrombium) attolus* Womersley, 1937.

*Acomatacarus attolus* Womersley, 1945.

Type, *Adult*: South Australian Museum.

New South Wales: Free.

## ACOMATACARUS DROMUS (Womersley, 1939) Womersley, 1945.

WOMERSLEY, H., 1939: *Trans. Roy. Soc. S. Aust.*, lxiii, ii, 149; *Idem*, 1945: *Ibid.*, lxix, i, 96.

*Microtrombidium (Dromeothrombium) dromus* Womersley, 1939 (*partim*).

*Dromeothrombium dromus* Womersley, 1945.

*Acomatacarus dromus* Womersley, 1945.

Type, *Adult*: South Australian Museum.

South Australia: Free.

## ACOMATACARUS PATRIUS Womersley, 1945.

WOMERSLEY, H., 1945: *Trans. Roy. Soc. S. Aust.*, lxix, i, 96.

*Microtrombidium (Dromeothrombium) dromus* Womersley, 1945 (*partim*).

*Acomatacarus patrius* Womersley, 1945.

Type, *Adult*: South Australian Museum.

South Australia: Free.

## ACOMATACARUS AUDYI Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.

*Acomatacarus audyi* Radford, 1946c. SAYERS *et al.*, 1947.

Type, *Larva*: British Museum.

Paratypes: Coll. Radford, Coll. André, U.S. Nat. Mus.

Manipur: ? babbler.

## ACOMATACARUS LYGOSOMAE Dumbleton, 1946.

DUMBLETON, L. J., 1946: *Trans. Roy. Soc. N.Z.*, lxxvi, iii, 409.

*Acomatacarus lygosomae* Dumbleton, 1946.

Type & Paratypes, *Larvae*: Cawthron Institute, Nelson, N.Z.

New Zealand: Skink (*Lygosoma grande*).

## PART XXV.

Genus *NEOTROMBIDIUM* (Leonardi, 1901) Berlese, 1912.

LEONARDI, G., 1901: *Zool. Anz.*, xxv, 18; BERLESE, A., 1912: *Redia*, viii, i, i.  
*Trombidium (Neotrombidium)* Leonardi, 1901.

*Neotrombidium* Berlese, 1912. Hirst, 1928; Womersley, 1934, 1945.  
*Neotrombidium* Leonardi, 1911 (*laps. cal.*). Womersley, 1937.

Genotype, *Neotrombidium furcigerum* (Leonardi, 1901) Berlese, 1912.

Womersley (1945) included this genus in the subfamily Leeuwenhoekinae because of the resemblance of adults of *Neotrombidium barringtonense* to the nymphs of *Acomatacarus*.

## NEOTROMBIDIUM BARRINGTONENSE Hirst, 1928.

HIRST, S., 1928: *Proc. Zool. Soc., Lond.*, 1021.

*Neotrombidium barringtonense* Hirst, 1928b. Womersley, 1934, 1937, 1945.

Type, Adult: South Australian Museum.

New South Wales & South Australia: Free.

## PART XXVI.

Genus *WOMERSLEYIA* Radford, 1946.

RADFORD, C. D., 1946: *Parasitology*, xxxvii, i/ii, 46.

*Womersleyia* Radford, 1946b. Lawrence, 1949.

Genotype, *Womersleyia minuta* Radford, 1946.

In Radford's description of *W. minuta* he did not give any indication of the numbers of leg segments, and without this information it is impossible to place any species in the key given by Wharton *et al.* (1951). However, Radford placed his genus in the Leeuwenhoekinae, and there it must stay for the present.\*

## WOMERSLEYIA MINUTA Radford, 1946.

RADFORD, C. D., 1946: *loc. cit. supra*.

*Womersleyia minuta* Radford, 1946b.

Type, Larva: British Museum.

Paratype, Coll. Radford, U.S. Nat. Mus., Coll. André.

Maldivian Is.: Grasshoppers (Acrididae, Tetrigidae, Tettigoniidae spp.).

## PART XXVII.

Subfamily *HEMITROMBICULINAE* Ewing, 1944.

EWING, H. E., 1944: *Proc. Biol. Soc. Wash.*, lvii, 101.

*Trombiculinae* Ewing, 1929 (*partim*).

*Hemitrombiculinae* Ewing, 1944a, 1944b, 1946a. Dumbleton, 1946; Wharton, 1947c.

Type Genus, *Hemitrombicula* Ewing, 1938.

I cannot see why Wharton (1947c) and Wharton *et al.* (1951) excluded this subfamily from the Trombiculidae, and I am retaining it here.

In 1946 Dumbleton erected the genus *Nothotrombicula* and placed it in this subfamily.

Genus *NOTHOTROMBICULA* Dumbleton, 1946.

DUMBLETON, L. J., 1946: *Trans. Roy. Soc. N.Z.*, lxxvi, iii, 409.

*Nothotrombicula* Dumbleton, 1946.

Genotype, *Nothotrombicula deinacridae* Dumbleton, 1946.

## NOTHOTROMBICULA DEINACRIDAE Dumbleton, 1946.

DUMBLETON, L. J., 1946: *loc. cit. supra*.

*Nothotrombicula deinacridae* Dumbleton, 1946.

Type, Larva: Entomological Division, Nelson, New Zealand.

New Zealand: Giant weta (*Deinacrida rugosa*?).

\* Radford informs me (personal communication) that this species has six segments in all legs.

## PART XXVIII.

## Subfamily WALCHIINAE Ewing, 1946.

EWING, H. E., 1946: *J. Parasit.*, xxii, v, 435.

Trombiculinae Ewing, 1929 (*partim*).

Walchiinae Ewing, 1946a. WHARTON, 1947c; Lawrence, Fuller, 1949; WHARTON *et al.*, 1951.

Type Genus, *Walchia* (Walch, 1927) Ewing, 1931.

In this subfamily Wharton (1947c) modified Ewing's original definition by laying down that legs I have seven segments, legs II and III have six segments, with at least four sternal setae, and only one seta on coxae I. This is made more difficult in the key given by Wharton *et al.* (1951), in which it is impossible to place any subfamily or genus unless one knows the number of leg segments. Moreover, it places *Schöngastia oudemansi* (Walch, 1922) in an unnatural position within this subfamily. However, since Fuller's new genus to accommodate *S. oudemansi* here is not yet published, I have left that species in *Schöngastia* for the present.

In addition to two promised new genera, the subfamily now contains, according to Wharton *et al.* (1951):

*Walchia* Ewing, 1931 (Type, *Trombidium glabrum* Walch, 1927).

*Schöngastiella* Hirst, 1915 (Type, *Schöngastiella bengalensis* Hirst, 1915).

*Gahrliepia* Oudemans, 1912 (Type, *Typhlothrombium nanus* Oudemans, 1910).

*Gateria* Ewing, 1938 (Type, *Gahrliepia fletcheri* Gater, 1932).

It seems to me that Gater's original argument (1932) for re-including *Schöngastiella* in *Gahrliepia* is still sound. *Gahrliepia* was described by Oudemans (1912a) as having eight scutal setae, and so when Hirst found a species bearing six, he naturally founded a new genus to accommodate it—but when Gater found six species with from 4 to 20 scutal setae, it became obvious that all of these, and *Schöngastiella*, too, rightly belonged in the one genus. Otherwise, to be consistent, we should erect a new genus for each species with a different number of scutal setae. Furthermore, it is surely splitting hairs to make the presence or absence of non-marginal setae a generic character (I am speaking of species within the original conception of *Gahrliepia*). I should like to see *Gateria* and *Schöngastiella* both re-included in *Gahrliepia*, but for the present I shall follow Wharton *et al.* (1951) and list all four of their existing genera in this subfamily.

## PART XXIX.

## Genus WALCHIA (Walch, 1927) Ewing, 1931.

WALCH, E. W., 1927: *Geneesk. Tijdschr. v. Ned.-Ind.*, lxvii, 922; EWING, H. E., 1931: *Proc. U.S. Nat. Mus.*, lxxx, viii, 1.

*Trombidium* Walch, 1927 (*nom. praeocc.*: = *Trombidium* Berlese, 1888 *nec* Fabricius, 1775). Fuller, 1949.

*Walchia* Ewing, 1931. Thor, 1935, 1936; Womersley, 1937, 1944; Radford, 1942, 1946c; Womersley & Heaslip, 1943; Thor & Willmann, 1947; Lawrence, 1949; WHARTON *et al.*, 1951.

*Walchia* Ewing, 1932: Womersley, 1937.

Genotype, *Walchia glabrum* (Walch, 1927) Ewing, 1931.

This genus is confined strictly to species with globose sensillae and only four scutal setae.

## WALCHIA GLABRUM (Walch, 1927) Ewing, 1931.

WALCH, E. W., 1927: *loc. cit. supra*; EWING, H. E., 1931: *loc. cit. supra*.

*Trombidium glabrum* Walch, 1927 (*non* *Trombidium glabrum* Dugès, 1834). Womersley, 1944; Fuller, 1949; Wharton *et al.*, 1951.

*Trombicula glabrum* (Walch, 1927) Ewing, 1931. Fuller, 1949.

*Walchia glabrum* Ewing, 1931. Gater, 1932; Gunther, 1941c; Radford, 1942; Womersley & Heaslip, 1943; Womersley, 1944; Blake *et al.*, 1945a; Griffiths, Sayers *et al.*, Thor & Willmann, 1947; FULLER, 1949.

- Trombidium* (*non* *Trombidium* Berlese, 1888 *nec* Fabricius, 1775) *ewinki* Fuller, 1949  
*(nom. praeocc.).* Wharton *et al.*, 1951.  
*(non)* *Walchia pingue* Gater, 1932: Womersley, 1944.  
*(non)* *Walchia pingue* Gater, 1932: Womersley & Heaslip, 1943 (?) *fide* Fuller, 1949.

The situation here is rather complicated. *Trombidium glabrum* Walch, 1927 (referring to *Trombidium* Berlese, 1888) is preoccupied by *Trombidium glabrum* Dugès, 1834 (referring to *Trombidium* Fabricius, 1775). In 1905 Berlese renamed his *Trombidium* (he states that *Trombicula* is derived from *Trombidium*), and so when Ewing (1931) referred to *Trombicula glabrum* (Walch, 1927) he was quite in order, despite Fuller's objection (1949).

Now Article 35 of the International Rules for Zoological Nomenclature states: "A specific name is to be rejected as a homonym when it has previously been used for some other species or subspecies of the same genus."

Thus *Trombidium glabrum* Walch was not a homonym of *T. glabrum* Dugès; since it was accompanied by a valid description, it was merely a *nomen praeoccupatum*, and Ewing did all that was necessary when he called it *Trombicula glabrum* (Walch, 1927)—his subsequent transfer of it to *Walchia* has nothing to do with the status of the name *glabrum*.

However, Fuller (1949) rejected *Trombidium glabrum* Walch as a homonym, and renamed the species *Trombidium ewinki*; this is meaningless, since it cannot refer either to *Trombidium* Fabricius or to *Trombidium* Berlese, and cannot replace *Walchia*, which also precedes it. Actually, Walch's species can be correctly referred to as: "*Trombidium glabrum* Walch, 1927 (*nec* Dugès, 1834)"; its present name is *Walchia glabrum* (Walch, 1927) Ewing, 1931; and Fuller's name must be translated as: "*Walchia ewinki* (Fuller, 1949)"—a synonym of *W. glabrum*.

Type, *Larva*.

Celebes: Rat.

Malaya: *R. argentifer*.

Java & Sumatra: Hosts not specified.

India: *R. brunnesculus*.

Burma: Shrew (*Tupaia belangeri*).

New Guinea: *R. praetor*, *Melomys* sp., free.

#### WALCHIA DISPARUNGUIS (Oudemans, 1929) Womersley, 1944.

OUDEMANS, A. C., 1929: *Ent. Ber. Ned. Ent. Ver.*, vii, cxv, 398; WOMERSLEY, H., 1944: *Trans. Roy. Soc. S. Aust.*, lxviii, i, 82.

*Schöngastielia disparunguis* Oudemans, 1929.

*Gahrtepia disparunguis* Gater, 1932.

*Walchia disparunguis* Womersley, 1944. Kohls *et al.*, 1945; Mohr, Griffiths, 1947; Fuller, 1949.

Type, *Larva*.

Java: *Mus rutilus*.

New Guinea: *R. browni*.

#### WALCHIA (?) ENODE Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Walchia enode* Gater, 1932. Radford, 1942; Hayakawa Tanaka *et al.*, 1945; Hayakawa & Hokari, 1947; Fuller, 1949.

*Walchia enodis* Womersley & Heaslip, 1943 (*laps. cal.*). Radford, 1946c; Sayers *et al.*, 1947.

In the absence of sensillae, the placing of this species is provisional.

Type, *Larva*: British Museum.

Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.

Malaya: *R. mülleri*.

Burma: *R. brunnesculus*, bandicoot (*Bandicota bengalensis*).

## WALCHIA LEWTHWAITEI Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Walchia lewthwaitei* Gater, 1932. Radford, Ewing, 1942; Womersley & Heaslip, 1943; Hayakawa Tanaka *et al.*, 1945; Hayakawa & Hokari, 1947; Fuller, 1949.  
Type, *Larva*: British Museum.  
Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.  
Malaya: Rats (*R. diardi*, *R. surifer*), squirrel (*Sciuropterus belone*).

## WALCHIA PINGUE Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Walchia pingue* Gater, 1932. Radford, 1942.

(non) *Walchia glabrum* Gater, 1932. Womersley, 1944; Fuller, 1949.  
Type, *Larva*: British Museum.  
Malaya: *R. ciliatus*.  
New Guinea: Free.

## WALCHIA RUSTICA (Gater, 1932) Womersley &amp; Heaslip, 1943.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143; WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, Ixvii, i, 68.

*Gahrliepia rustica* Gater, 1932. Radford, 1942.

*Walchia rustica* Womersley & Heaslip, 1943. Fuller, 1949.  
Type, *Larva*: British Museum.  
Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.  
Malaya: *R. surifer*.

## WALCHIA (?) TURMALIS (Gater, 1932) Womersley &amp; Heaslip, 1943.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143; WOMERSLEY, H., & HEASLIP, W. G., 1943: *Trans. Roy. Soc. S. Aust.*, Ixvii, i, 68.

*Gahrliepia turmalis* Gater, 1932. Gunther, 1940b; Ewing, Radford, 1942.

*Walchia turmalis* Womersley & Heaslip, 1943. Radford, 1946b; Fuller, 1949.  
In the absence of sensillae, the placing of this species is provisional.  
Type, *Larva*: British Museum.  
Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.  
Malaya: *R. vociferans*.  
Ceylon: Shrew (*Suncus giganteus*).

## WALCHIA MOROBENSIS Gunther, 1939.

GUNTHER, C. E. M., 1939: *Proc. Linn. Soc. N.S.W.*, Ixiv, i/ii, 73.

*Walchia buloloensis* Gunther, 1938 (*nom. nud.*).

*Walchia morobensis* Gunther, 1939a, 1940a, 1940d, 1942. Radford, 1942; Womersley & Heaslip, 1943; Fuller, 1949.  
Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.  
Paratypes, *Larvae*: British Mus., Australian Mus., S. Australian Mus., Univ. California, Tulane Univ., Natal Mus., P. H. D. Entebbe.  
New Guinea: *R. brownii*, *R. ringens*.

## WALCHIA (?) RIOI (Gunther, 1940).

GUNTHER, C. E. M., 1940: *Proc. Linn. Soc. N.S.W.*, Ixv, iii/iv, 479.

*Gahrliepia rioi* Gunther, 1940b. Womersley & Heaslip, 1943.

This is, of course, going too far—the shape of the scutum definitely places this species in *Gahrliepia*, but since I am here following Wharton *et al.* (1951), the fact that this species has only four scutal setae leaves it nowhere else to go but in *Walchia*. However, since the sensillae are missing, any placing must be regarded as provisional.

Type, *Larva*: School Public Health Trop. Med., Univ. Sydney.

Paratypes, *Larvae*: British Museum, Australian Museum.

British North Borneo: Mouse deer (*Tragulus borneanus*).

## PART XXX.

Genus *GAHRLIEPIA* (Oudemans, 1910) Oudemans, 1912.

OUDEMANS, A. C., 1910: *Ent. Ber. Ned. Ent. Ver.*, iii, liv, 86; *Idem*, 1912: *Ibid.*, lxvii, 272.

*Typhlothrombium* Oudemans, 1910a (*nom. praeocc.* : *non Typhlothrombium* Berlese, 1910).

*Gahrliepia* Oudemans, 1912a. Warburton, 1928; Gater, 1932; Thor, 1935, 1936; Womersley, 1937; EWING, 1938, 1942, 1946a; Gunther, 1940b; Womersley & Heaslip, 1943; RADFORD, 1946c; Thor & Willmann, 1947; Lawrence, 1949; WHARTON *et al.*, 1951.

(*non*) *Schöngastiella* Hirst, 1915b. Gater, 1932; Womersley & Heaslip, 1943.

(*non*) *Gateria* Ewing, 1938. Womersley & Heaslip, 1943.

Genotype, *Gahrliepia nanus* (Oudemans, 1910) Oudemans, 1912.

I am following Wharton *et al.*, 1951, in that I am regarding *Gahrliepia* as having more than six setal setae, all of which are marginal.

## GAHRLIEPIA CETRATA Gater, 1932.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143.

*Gahrliepia cetrata* Gater, 1932. Radford, 1942; Womersley & Heaslip, 1943.

Type, *Larva*: British Museum.

Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.

Malaya: *R. ciliatus*.

## PART XXXI.

Genus SCHÖNGASTIELLA Hirst, 1915.

HIRST, S., 1915: *Bull. Ent. Res.*, vi, iii, 183.

*Schöngastiella* Hirst, 1915b. Thor, 1935, 1936; Womersley, 1937; EWING, 1938, 1942, 1944a, 1944b, 1946a; Radford, 1942, 1946c; Thor & Willmann, 1947; Lawrence, 1949; WHARTON *et al.*, 1951.

(*non*) *Schöngastiella* Oudemans, 1929.

(*non*) *Gahrliepia* (Oudemans, 1910). Gater, 1932; Gunther, 1940b; Womersley & Heaslip, 1943.

Genotype, *Schöngastiella bengalensis* Hirst, 1915.

I am following Wharton *et al.*, 1951, in that I include here those species with six setal setae.

## SCHÖNGASTIELLA BENGALENSIS Hirst, 1915.

HIRST, S., 1915: *loc. cit. supra*.

*Schöngastiella bengalensis* Hirst, 1915b. Radford, 1942; WHARTON *et al.*, 1951.

*Gahrliepia bengalensis* Gater, 1932. Womersley & Heaslip, 1943; Finnegan, 1945.

*Gateria bengalensis* Ewing, 1938, *fide* Womersley & Heaslip, 1943.

Type, *Larva*: British Museum.

Bengal: *Mus rattus*.

## SCHÖNGASTIELLA BREVIS Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.

*Schöngastiella brevis* Radford, 1946c. Sayers *et al.*, 1947.

Type, *Larva*: British Museum.

Imphal: *R. brunnesculus*.

## SCHÖNGASTIELLA LIGULA Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.

*Schöngastiella ligula* Radford, 1946c. Sayers *et al.*, 1947; AUDY & HARRISON, TRAUB *et al.*, 1950.

Type, *Larva & nymph*: British Museum.

Paratypes, *Larvae & nymphs*: Coll. Radford.

Imphal: Rat.

## SCHÖNGASTIELLA PUNCTATA Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.  
*Schöngastiella punctata* Radford, 1946c. Sayers et al., 1947.

Type, *Larva*: British Museum.

Imphal: *R. brunneulus*, shrew (*Suncus fulvocinereus*).

## PART XXXII.

## Genus GATERIA Ewing, 1938.

EWING, H. E., 1938: *J. Wash. Acad. Sci.*, xxviii, 288.  
*Gahrliepia* (Oudemans, 1910) Oudemans, 1912 (*partim*).  
*Gateria* Ewing, 1938, 1942, 1944a, 1944b, 1946a. Radford, 1942, 1946c; Lawrence, 1949;  
 WHARTON et al., 1951.

(non) *Gahrliepia* (Oudemans, 1910). Womersley & Heaslip, 1943; Audy, 1947.

Genotype, *Gateria fletcheri* (Gater, 1932) Ewing, 1938.

I am here following Wharton et al., 1951, in that I am including those species with more than six scutal setae, not all of which are marginal.

## GATERIA FLETCHERI (Gater, 1932) Ewing, 1938.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143; EWING, H. E., 1938: *J. Wash. Acad. Sci.*, xxviii, 288.

*Gahrliepia fletcheri* Gater, 1932. Audy, 1947.

*Gahrliepia fletcheri* Gater, 1938. Womersley & Heaslip, 1943.

*Gateria fletcheri* Ewing, 1938. Radford, 1942.

Type, *Larva*: British Museum.

Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.

Malaya: Rats (*R. diardi*, *R. vociferans*), squirrels (*Sciurus caniceps*, *Rhinosciurus tupaioides*), shrew (*Tupaia ferruginea*).

## GATERIA (?) CILIATA (Gater, 1932) Radford, 1942.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143; RADFORD, C. D., 1942: *Ibid.*, xxxiv, 55.

*Gahrliepia ciliata* Gater, 1932. Gunther, 1940b; Womersley & Heaslip, 1943.

*Gateria ciliata* Radford, 1942.

In the absence of sensillae, the placing of this species is provisional.

Type, *Larva*: British Museum.

Malaya: *R. mülleri*.

## GATERIA (?) RUTILA (Gater, 1932) Radford, 1942.

GATER, B. A. R., 1932: *Parasitology*, xxiv, ii, 143; RADFORD, C. D., 1942; *Ibid.*, xxxiv, 55.

*Gahrliepia rutila* Gater, 1932. Womersley & Heaslip, 1943.

*Gateria rutila* Radford, 1942.

In the absence of sensillae, the placing of this species is provisional.

Type, *Larva*: British Museum.

Paratypes, *Larvae*: U.S. National Museum, Molteno Institute.

Malaya: *R. mülleri*.

## GATERIA CROCIDURA Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.  
*Gateria crocidura* Radford, 1946c. Sayers et al., 1947.

Type, *Larva*: British Museum.

Imphal: Shrew (*Suncus fulvocinereus*).

## GATERIA HIRSUTA Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.  
*Gateria hirsuta* Radford, 1946c. Sayers et al., 1947.

Type, *Larva*: British Museum.

Paratypes, Coll. Radford, Coll. André, U.S. Nat. Mus.

Imphal: Shrew (*Suncus fulvocinereus*).

## GATERIA LONGIPILI Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.*Gateria longipili* Radford, 1946c. Sayers et al., 1947.Type, *Larva*: British Museum.Imphal: Shrew (*Suncus fulvocinereus*).

## GATERIA LANCIARIA Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.*Gateria lancaria* Radford, 1946c. Sayers et al., 1947.Type, *Larva*: British Museum.Imphal: Mole (*Talpa micrura*).

## GATERIA SPINULOSA Radford, 1946.

RADFORD, C. D., 1946: *Proc. Zool. Soc.*, cxvi, ii, 247.*Gateria spinulosa* Radford, 1946c. Sayers et al., 1947.Type, *Larva*: British Museum.Imphal: Shrew (*Suncus fulvocinereus*).

## PART XXXIII.

## INDEX OF GEOGRAPHICAL DISTRIBUTION.

(The Roman numerals indicate the Parts in which the species may be found.)

## A: LARVAE ATTACKING MAN.

The following have been recorded as attacking man in the countries shown:

*Acomatacarus australiensis*, XXIV: Australia.*A. barrinensis*, XXIV: Queensland.*Schöngastia blestowei*, XIII: New Guinea.*S. katonis*, XIII: Parao Isles.*S. oudeansi*, XIII: Sumatra.*S. pseudo-schüffneri*, XIII: Sumatra.*S. pusilla*, XIII: New Guinea.*S. schüffneri*, XIII: Sumatra.*S. vandersandei*, XIII: British Solomon Is., Dutch New Guinea.*Trombicula acuscutellaris*, IX: Malaya.*T. akamushi*, VII: Japan, Malaya.*T. deliensis*, VIII: Malaya, Sumatra.*T. hirsti*, V: Formosa, Malaya, New Guinea, Queensland, Sumatra.*T. japonica*, VII: Japan.*T. keukenschrijveri*, IX: Sumatra.*T. rara*, IX: Sumatra.*T. samboni*, XII: South Australia.*T. sarcina*, XII: Queensland.*T. wichmanni*, VI: Celebes, Philippine Is.

## B: GEOGRAPHICAL DISTRIBUTION.

Trombiculid mites have been reported in the following countries:

AUSTRALIA: *Acomatacarus adelaideae*, *A. athertonensis*, *A. attolus*, *A. australicensis*, *A. barrinensis*, *A. dromus*, *A. echidnus*, *A. hirsti*, *A. mecculochi*, *A. patrius*, *A. retentus*, *A. southcotti*, XXIV; *Guntherana bipygalis*, II; *Myotrombicula vespertilionis*, XVI; *Neoschöngastia antipodianum*, *N. cairnsensis*, *N. coorongensis*, *N. dasycerci*, *N. derricki*, *N. guntheri*, *N. heastlipi*, *N. hirsti*, *N. indica*, *N. innisfailensis*, *N. melomys*, *N. perameles*, *N. petrogale*, *N. phascogale*, *N. queenslandica*, *N. rattus*, *N. similis*, *N. smithi*, *N. trichosuri*, *N. westraliense*, XIV; *Neotrombiculum barringtonense*, XXV; *Trombicula chiroptera*, XII; *T. deliensis*, VIII; *T. hirsti*, V; *T. novae-hollandiae*, *T. quadriense*, *T. samboni*, *T. sarcina*, *T. signata*, *T. tindalei*, *T. translucens*, XII.

BORNEO: *Neoschöngastia impar*, XIV; *Trombicula bodensis*, IX; *T. wichmanni*, V; *Walchia rioi*, XXIX.

BRITISH SOLOMON IS.: *Hannemania vellae*, XXIII; *Schöngastia vandersandei*, XIII.

BRUNEI: *Trombicula wickmanni*, VI.

BURMA: *Mackienia empodiformis*, XX; *Neoschöngastia indica*, *N. masto*, *N. mutabilis*, XIV; *Trisetica melvini*, XXI; *Trombicula akamushi*, VII; *T. burmensis*, *T. deliensis*, *T. fulleri*, VIII; *Walchia enode*, XXIX.

CELEBES: *Acomatacarus australiensis*, XXIV; *Neoschöngastia globulare*, *N. indica*, XIV; *Trombicula hirsti*, V; *T. wickmanni*, VI; *Walchia glabrum*, XXIX.

CEYLON: *Neoschöngastia indica*, XIV; *Trombicula acuscutellaris*, IX; *T. akamushi*, VII; *T. deliensis*, VIII; *Walchia turmalis*, XXIX.

CHINA: *Trombicula akamushi*, VII; *T. deliensis*, VIII.

FORMOSA: *Neoschöngastia gallinarum*, XIV; *Trombicula akamushi*, *T. corvi*, VII; *T. deliensis*, VIII; *T. hirsti*, V; *T. isshikii*, *T. pseudoakamushi*, VII.

GUAM: *Neoschöngastia bougainvillensis*, *N. carveri*, *N. ewingi*, *N. indica*, *N. namrui*, *N. solomonis*, *N. strongi*, XIV; *Trombicula anous*, *T. pluvius*, XI.

INDIA: *Acomatacarus audyi*, XXIV; *Gateria crocidura*, *G. hirsuta*, *G. laniaria*, *G. longipili*, *G. spinulosa*, XXXII; *Neoschöngastia indica*, *N. lanius*, *N. manipurensis*, *N. thomasi*, XIV; *Schöngastiella bengalensis*, *S. brevis*, *S. ligula*, *S. punctata*, XXXI; *Trombicula cervulicola*, *T. coluberina*, X; *T. deliensis*, VIII; *T. gliricolens*, X; *T. hakei*, VI; *T. squamosus*, X.

IWO JIMA: *Neoschöngastia solomonis*, XIV.

JAPAN: *Trombicula akamushi*, *T. fuji*, *T. fujigmo*, *T. intermedia*, *T. japonica*, *T. pallida*, *T. palpalis*, *T. scutellaris*, *T. tamiyai*, VII.

JAVA: *Neoschöngastia salmi*, *N. soekabocmienensis*, XIV; *Trombicula deliensis*, VIII; *T. mediocris*, *T. minor*, V; *Walchia disparunguis*, *W. glabrum*, XXIX.

MALAYA: *Ascoshöngastia malayensis*, XV; *Gahrliepia cetrata*, XXX; *Gateria ciliata*, *G. fletcheri*, *G. rutila*, XXXII; *Heaslipia gateri*, XVIII; *Neoschöngastia debilis*, *N. gallinarum*, *N. indica*, *N. lacunosa*, *N. mutabilis*, XIV; *Schöngastia oudemani*, *S. vieta*, XIII; *Trombicula acuscutellaris*, IX; *T. akamushi*, VII; *T. batui*, IX; *T. deliensis*, VIII; *T. hastata*, IX; *T. hirsti*, V; *T. insolli*, *T. keukenschrijveri*, *T. munda*, *T. spicata*, IX; *Walchia enode*, *W. glabrum*, *W. leuthwaitei*, *W. pingue*, *W. rustica*, *W. turmalis*, XXIX.

MALDIVE IS.: *Neoschöngastia indica*, XIV; *Schöngastia maldivensis*, XIII; *Trombicula acuscutellaris*, IX; *T. akamushi*, VII; *T. deliensis*, VIII; *Womersleyia minuta*, XXVI.

MOROTAI: *Trombicula wickmanni*, VI.

NEPAL: *Trombicula akamushi*, VII; *T. deliensis*, VIII.

NEW GUINEA: *Acomatacarus australiensis*, *A. longipes*, *A. nova-guinea*, XXIV; *Guntherana bipygialis*, *G. parana*, II; *Neoschöngastia backhousei*, *N. bougainvillensis*, *N. bushlandi*, *N. dubia*, *N. echymipera*, *N. edwardsi*, *N. foliata*, *N. impar*, *N. lorius*, *N. mccullochi*, *N. ratus*, *N. retrocincta*, *N. riversi*, *N. shieldsi*, *N. solomonis*, *N. uromys*, *N. womersleyi*, *N. yeomansi*, XIV; *Novotrombicula oviensis*, XIX; *Oenoschöngastia cana*, XVII; *Schöngastia blestowei*, *S. jamesi*, *S. philipi*, *S. pusilla*, *S. taylori*, *S. vander-**sandei*, XIII; *Trombicula akamushi*, VII; *T. deliensis*, VIII; *T. densipiliata*, IX; *T. frittsi*, *T. gymnodactyla*, XI; *T. hirsti*, V; *T. kohlsi*, *T. nissani*, XI; *T. obscura*, VII; *T. pluvius*, XI; *T. rara*, IX; *T. rioi*, *T. robusta*, *T. scincoides*, XI; *T. wickmanni*, VI; *Walchia disparunguis*, *W. morobensis*, *W. pingue*, XXIX.

NEW ZEALAND: *Acomatacarus lygosomae*, XXIV; *Nothotrombicula deinacridae*, XXVII; *Trombicula naultini*, XII.

OKINAWA: *Neoschöngastia atollensis*, *N. carveri*, *N. egretta*, *N. monticola*, *N. namrui*, *N. posekanyi*, *N. solomonis*, XIV.

PALAU IS.: *Neoschöngastia ewingi*, *N. yeomansi*, XIV.

PARAO IS.: *Schöngastia katonis*, XIII.

PELELIU IS.: *Neoschöngastia carveri*, *N. ewingi*, *N. strongi*, XIV.

PESCADORES IS.: *Trombicula akamushi*, VII.

PHILIPPINE IS.: *Neoschöngastia indica*, *N. kohlsi*, *N. philippensis*, *N. riversi*, XIV; *Schöngastia blestowei*, *S. pusilla*, XIII; *Trombicula akamushi*, VII; *T. bodensis*, IX; *T. deliensis*, VIII; *T. piercei*, *T. scincoides*, XI; *T. wickmanni*, VI.

SUMATRA: *Neoschöngastia indica*, XIV; *Schöngastia oudemani*, *S. pseudo-schüffneri*, *S. schüffneri*, XIII; *Trombicula acuscutellaris*, IX; *T. deliensis*, VIII; *T. densipiliata*, IX; *T. hirsti*, V; *T. keukenschrijveri*, IX; *T. pseudoakamushi*, VII; *T. rara*, IX; *Walchia glabrum*, XXIX.

ULITHI, IS.: *Neoschöngastia atollensis*, *N. carveri*, *N. egretta*, *N. ewingi*, *N. namrui*, *N. pauensis*, XIV.

#### PART XXXIV.

##### INDICES OF PARTS AND OF SPECIES AND SYNONYMS.

###### A: INDEX OF PARTS (see also p. 60).

- I.—The Family Trombiculidae in Asia and Australasia.
- II.—The subfamily Guntheraninae (*subf. nov.*).
- III.—The subfamily Trombiculinae.
- IV.—The genus *Trombicula*.
- V.—*Trombicula minor*, *T. mediocris*, and *T. hirsti*.
- VI.—*Trombicula wichmanni* and *T. hakei*.
- VII.—The Japanese and Formosan Trombiculæ.
- VIII.—*Trombicula deliensis*, *T. burmensis*, and *T. fulleri*.
- IX.—The Trombiculæ of Malaya and the East Indies.
- X.—The Trombiculæ of India and Burma.
- XI.—The Trombiculæ of the south-west Pacific.
- XII.—The Trombiculæ of Australia and New Zealand.
- XIII.—The genus *Schöngastia*.
- XIV.—The genus *Neoschöngastia*.
- XV.—The genus *Ascuschöngastia*.
- XVI.—The genus *Myotrombicula*.
- XVII.—The genus *Oenoschöngastia*.
- XVIII.—The genus *Heaslipia*.
- XIX.—The genus *Novotrombicula*.
- XX.—The genus *Mackiena*.
- XXI.—The genus *Trisetica*.
- XXII.—The subfamily Leeuwenhoekiinae.
- XXIII.—The genus *Hannemania*.
- XXIV.—The genus *Acomatacarus*.
- XXV.—The genus *Neotrombicidium*.
- XXVI.—The genus *Womersleyia*.
- XXVII.—The subfamily Hemitrombiculinae and the genus *Nothotrombicula*.
- XXVIII.—The subfamily Walchiinae.
- XXIX.—The genus *Walchia*.
- XXX.—The genus *Gahrliepia*.
- XXXI.—The genus *Schöngastiella*.
- XXXII.—The genus *Gateria*.
- XXXIII.—Index of geographical distribution.
- XXXIV.—Indices of Parts and of species and synonyms.
- XXXV.—Bibliography.

###### B: INDEX OF SPECIES AND SYNONYMS.

(The Roman numerals indicate the Part in which a species may be found;  
see p. 60 for pagination of Parts.)

Acarinida, (Acarina), i.	<i>Acomatacarus attolus</i> , xxiv.
<i>Acariscus</i> , ( <i>Trombicula</i> ), iv.	<i>audyi</i> , xxiv.
<i>anous</i> , ( <i>Trombicula anous</i> ), xi.	<i>australiensis</i> (-e), xxiv.
<i>gymnodactyla</i> , ( <i>T. gymnodactyla</i> ), xi.	<i>barrinensis</i> , xxiv.
<i>pluvius</i> , ( <i>T. pluvius</i> ), xi.	<i>dromus</i> , xxiv.
<i>Acomatacarus</i> , xxiv.	<i>echidnus</i> , xxiv.
<i>adelaidae</i> , xxiv.	<i>hirsti</i> , xxiv.
<i>athertonensis</i> , xxiv.	<i>longipes</i> , xxiv.

- Acomatacarus lygosomae*, xxiv.  
*mccullochi*, xxiv.  
*nova-guinea*, xxiv.  
*patrius*, xxiv.  
*retentus*, xxiv.  
*southcotti*, xxiv.  
*Allotrombidium wichmanni*,  
 (*Trombicula wichmanni*), vi.  
*Apoloniinae*, i.  
*Ascoshöngastia*, (*Neoschöngastia*), xiv.  
*bushlandi*, (*Neoschöngastia bush-*  
*landi*), xiv.  
*cockingsi*, (*N. indica*), xiv.  
*coorongense*, (*N. coorongense*), xiv.  
*echymipera*, (*N. echymipera*), xiv.  
*foliata*, (*N. foliata*), xiv.  
*hastata*, (*Trombicula hastata*), ix.  
*impar*, (*Neoschöngastia impar*), xiv.  
*indica*, (*N. indica*), xiv.  
*innisfailensis*, (*N. innisfailensis*), xiv.  
*kohlsi*, (*N. kohlsi*), xiv.  
*lanius*, (*N. lanius*), xiv.  
*malayensis*, (*Ascoshöngastia*  
*malayensis*), xv.  
*manipurensis*, (*Neoschöngastia*  
*manipurensis*), xiv.  
*masta*, (*N. masta*), xiv.  
*mccullochi*, (*N. mccullochi*), xiv.  
*mutabilis*, (*N. mutabilis*), xiv.  
*philippensis*, (*N. philippensis*), xiv.  
*uromys*, (*N. uromys*), xiv.  
*Austracarus*, (*Acomatacarus*), xxiv.  
*Austrombicula*, (*Acomatacarus*), xxiv.  
*Blankaartia*, (*Trombicula*), iv.  
*Calothrombium retentus*, (*Acomatacarus*  
*retentus*), xxiv.  
*Crotiscus*, (*Trombicula*), iv.  
*Dromeothrombium attolus*, (*Acomata-*  
*carus attolus*), xxiv.  
*dromus*, (*A. dromus*), xxiv; (*A.*  
*patrius*), xxiv.  
*Enemothrombium retentus*, (*A.*  
*retentus*), xxiv.  
*Euschöngastia*, (*Neoschöngastia*), xiv.  
*indica*, (*N. indica*), xiv.  
*lacunosa*, (*N. lacunosa*), xiv.  
*Eutrombicula* (*Trombicula*), iv.  
*buloloensis*, (*T. hirsti*), v.  
*gymnodactyla*, (*T. gymnodactyla*), xi.  
*hirsti*, (*T. hirsti*), v.  
*rara*, (*T. rara*), ix.  
*wichmanni*, (*T. wichmanni*), vi.  
*Fonsecia*, (*Trombicula*), iv.  
*coluberina*, (*T. coluberina*), x.  
*Gahrriegia*, xxx.  
*bengalensis*, (*Schöngastiella*  
*bengalensis*), xxxi.  
*brevis*, (*S. brevis*), xxxi.  
*cetrata*, (*Gahrriegia cetrata*), xxx.  
*ciliata*, (*Gateria ciliata*), xxxii.  
*disparunguis*, (*Walchia disparunguis*),  
 xxix.  
*fletcheri*, (*Gateria fletcheri*), xxxii.  
*rio*, (*Walchia rio*), xxix.  
*rustica*, (*W. rustica*), xxix.  
*rutila*, (*Gateria rutila*), xxxii.  
*turmalis*, (*Walchia turmalis*), xxix.  
*Gateria*, xxxii.  
*ciliata*, xxxii.  
*crocidura*, xxxii.  
*fletcheri*, xxxii.  
*hirsuta*, xxxii.  
*lancaria*, xxxii.  
*longipili*, xxxii.  
*rutila*, xxxii.  
*spinulosa*, xxxii.  
*Guntherana*, ii.  
*bipygalis*, ii.  
*kallipygos*, (*G. bipygalis*), ii.  
*parana*, ii.  
*Guntheraninae*, i, ii.  
*Guntheria*, (*Guntherana*), ii.  
*bipygalis*, (*G. bipygalis*), ii.  
*kallipygos*, (*G. bipygalis*), ii.  
*Hannemania blestowei*, (*Acomatacarus*  
*australiensis*), xxiv.  
*vellae*, xxiii.  
*Heaslipia gateri*, xviii.  
*Hemitrombiculinae*, i, xxvii.  
*Heterotrombidium wichmanni*,  
 (*Trombicula wichmanni*), vi.  
*Hyrcaricus*, (*Acomatacarus*), xxiv.  
*Kedania tanakai*, (*Trombicula*  
*akamushi*), vii.  
*Leeuwenhoekia*, xxii.  
*adelaideae*, (*Acomatacarus adelaideae*),  
 xxiv.  
*australiensis* (-e), (*A. australiensis*),  
 xxiv.  
*hirsti*, (*A. hirsti*), xxiv.  
*mccullochi*, (*A. mccullochi*), xxiv.  
*nova-guinea*, (*A. nova-guinea*), xxiv.  
*southcotti*, (*A. southcotti*), xxiv.  
*Leeuwenhoekiidae*, i, xxii.  
*Leeuwenhoekinae*, i, xxii.  
*Leeuwenhoekinae*, (*Leeuwenhoekinae*),  
 i, xxii.  
*Leptotrombidium*, (*Trombicula*), iv.  
*akamushi*, (*T. akamushi*), vii.  
*fiji*, (*T. fiji*), vii.

- Leptus akamushi*, (*T. akamushi*), vii.  
*L. autumnalis japonica*, (*T. japonica*), vii.  
*Mackiena empodiformis*, xx.  
*Megatrombicula*, (*Trombicula*), iv.  
*Microtrombidium*, (*Trombicula*), iv.  
*akamushi*, (*T. akamushi*), vii.  
*attolus*, (*Acomatacarus attolus*), xxiv.  
*brumpti*, (*Trombicula akamushi*), vii.  
*dromus*, (*Acomatacarus dromus*), xxiv; (*A. patrius*), xxiv.  
*gliricolens*, (*Trombicula gliricolens*), x.  
*retentus*, (*Acomatacarus retentus*), xxiv.  
*vandersandei*, (*Schöngastia vander-sandei*), xiii.  
*wichmanni*, (*Trombicula wichmanni*), vi.  
*Myotrombicula vespertilionis*, xvi.  
*Neoschöngastia*, xiv.  
*americanus* var. *solomonis*, (*N. solomonis*), xiv.  
*antipodianum*, xiv.  
*atollensis*, xiv.  
*backhousei*, xiv.  
*bipygalis*, (*Guntherana bipygalis*), ii.  
*bodensteini*, (*N. impar*), xiv.  
*bougainvillensis*, xiv.  
*bushlandi*, xiv.  
*cairnsensis*, xiv.  
var. *gateri*, (*N. cairnsensis*), xiv.  
*callipygea*, (*Guntherana bipygalis*), ii.  
*carveri*, xiv.  
*clauda*, (*N. impar*), xiv.  
*cockingsi*, (*N. indica*), xiv.  
*coorongense* (-is), (*N. coorongense*), xiv.  
*dasycerci*, xiv.  
*debilis*, xiv.  
*derricki*, xiv.  
*dubia*, xiv.  
*echymipera*, xiv.  
*edwardsi*, xiv.  
*egretta*, xiv.  
*ewingi*, xiv.  
*foliata*, xiv.  
*fournieri*, (*N. backhousei*), xiv.  
*gallinarum*, xiv.  
*globulare*, xiv.  
*guntheri*, xiv.  
*hastata*, (*Trombicula hastata*), ix.  
*heaslipi*, xiv.  
*hirsti*, xiv.  
*impar*, xiv.  
*incerta*, (*N. dubia*), xiv.
- Neoschöngastia indica*, xiv.  
*innisfailensis*, xiv.  
*isoodon*, (*N. perameles*), xiv.  
*jamesi*, (*N. yeomansi*), xiv.  
*jimungi*, (*N. lorius*), xiv.  
*kallipygos*, (*Guntherana bipygalis*), ii.  
*kohlsi*, xiv.  
*lacunosa*, xiv.  
*lanius*, xiv.  
*lorius*, xiv.  
*malayensis*, (*Ascoshöngastia malayensis*), xv.  
*manipurensis*, xiv.  
*mccullochi*, xiv.  
*melomys*, xiv.  
*minor*, (*Trombicula hirsti*), v.  
*monticola*, xiv.  
*muris*, (*N. indica*), xiv.  
*mutabilis*, xiv.  
*namrui*, xiv.  
*oudemansi*, (*Schöngastia oudemansi*), xiii.  
*pauensis*, xiv.  
*perameles*, xiv.  
*petrogale*, xiv.  
*phascogale*, xiv.  
*philippensis*, xiv.  
*posekanyi*, xiv.  
*pseudoschüffneri*, (*Schöngastia pseudoschüffneri*), xiii.  
*queenslandica*, xiv.  
*rattus*, xiv.  
*retrocincta*, xiv.  
*retrocoronata*, (*N. retrocincta*), xiv.  
*rioi*, (*N. edwardsi*), xiv.  
*riversi*, xiv.  
*salmi*, xiv.  
*schüffneri*, (*Schöngastia schüffneri*), xiii.  
*shieldsi*, xiv.  
*similis*, xiv.  
*smithi*, xiv.  
*soekaboemiensis*, xiv.  
*solomonis*, xiv.  
*strongi*, xiv.  
*thomasi*, xiv.  
*trichosuri*, xiv.  
*uromys*, xiv.  
*westraliense* (-is), xiv.  
var. *trichosuri*, (*N. trichosuri*), xiv.  
*womersleyi*, xiv.  
*yeomansi*, xiv.
- Neotrombicula*, (*Trombicula*), iv.  
*Neotrombidium barringtonense*, xxv.  
*Nothotrombicula deinacridae*, xxvii.

- Novotrombicula oviensis*, xix.  
*Oenoschöngastia cana*, xvii.  
*Paraschöngastia*, (*Neoschöngastia*), xiv.  
*backhousei*, (*N. backhousei*), xiv.  
*dubia*, (*N. dubia*), xiv.  
*gallinarum*, (*N. gallinarum*), xiv.  
*megapodius*, (*N. backhousei*), xiv.  
*retrocincta*, (*N. retrocincta*), xiv.  
*thomasi*, (*N. thomasi*), xiv.  
*yeomansi*, (*N. yeomansi*), xiv.  
*Pentagonella*, (*Trombicula*), iv.  
*acuscuteellaris*, (*T. acuscuteellaris*), ix.  
*Rhyncholophus attolus*, (*Acomatacarus attolus*), xxiv.  
*retentus*, (*A. retentus*), xxiv.  
*Schöngastia*, xiii.  
*antipodianum*, (*Neoschöngastia antipodianum*), xiv.  
*blestowei*, xiii.  
 var. *megapodius*, (*Schöngastia blestowei*), xiii.  
*coorongense* (-is), (*Neoschöngastia coorongense*), xiv.  
*dasycerci*, (*N. dasycerci*), xiv.  
*indica*, (*N. indica*), xiv.  
*jamesi*, xiii.  
*katonis*, xiii.  
*maldicensis*, xiii.  
*minor*, (*Trombicula hirsti*), v.  
*oudemansi*, xiii.  
*petrogale*, (*Neoschöngastia petrogale*), xiv.  
*philipi*, xiii.  
*pseudo-schüffneri*, xiii.  
*pusilla*, xiii.  
*rotunda*, (*S. jamesi*), xiii.  
*salmi*, (*Neoschöngastia salmi*), xiv.  
*schüffneri*, xiii.  
*taylori*, xiii.  
*vandersandei*, xiii.  
*vieta*, xiii.  
*westraliense*, (*Neoschöngastia westraliense*), xiv.  
*yeomansi*, (*S. blestowei*), xiii.  
*Schöngastiella*, xxxi.  
*bengalensis*, xxxi.  
*brevis*, xxxi.  
*disparunguis*, (*Walchia disparunguis*), xxix.  
*ligula*, xxxi.  
*punctata*, xxxi.  
*Trombicula*, (*Trombicula*), iv.  
*acuscuteellaris*, (*T. acuscuteellaris*), ix.  
*delhiensis*, (*T. deliensis*), viii.  
*fletcheri*, (*T. akamushi*), vii.  
*Trombicula intermedia*, (*T. intermedia*), vii.  
*mediocris*, (*T. mediocris*), vii.  
*minor*, (*T. minor*), v.  
*pallida*, (*T. pallida*), vii.  
*palpalis*, (*T. palpalis*), vii.  
*schüffneri*, (*Schöngastia schüffnerai*), xiii.  
*Thrombidium*, (*Trombicula*), iv.  
*akamushi*, (*T. akamushi*), vii.  
*vandersandei*, (*Schöngastia vandersandei*), xiii.  
*wichmanni*, (*Trombicula wichmanni*), vi.  
*Trägårdhula*, (*Trombicula*), iv.  
*Trisetica melvini*, xxi.  
*Trombicula*, iv-xii.  
*acuscuteellaris*, ix.  
*akamushi*, vii.  
 var. *pallida*, (*Trombicula pallida*), vii.  
*anous*, xi.  
*australiensis*, (*Acomatacarus australiensis*), xxiv.  
*autumnalis japonica*, (*Trombicula japonica*), vii.  
*batui*, ix.  
*bodenensis*, ix.  
*buloloensis*, (*T. hirsti*), v.  
*burmensis*, viii.  
*cervulicola*, x.  
*chiroptera*, xii.  
*coluberina*, x.  
*corvi*, vii.  
*deliensis*, (*Trombicula deliensis*), viii.  
*deliensis*, viii.  
*densipiliata*, ix.  
*diliensis*, (*Trombicula diliensis*), viii.  
*edwardsi*, (*Trombicula ritoi*), xi.  
*fletcheri*, (*T. akamushi*), vii.  
*frittsi*, xi.  
*fiji*, vii.  
*fujigmo*, vii.  
*fulleri*, viii.  
*gallinarum*, (*Neoschöngastia gallinarum*), xiv.  
*glabrum*, (*Walchia glabrum*), xxix.  
*gliricolens*, x.  
*globulare*, (*Neoschöngastia globulare*), xiv.  
*gymnodactyla*, xi.  
*hakei*, vi.  
*hastata*, ix.  
*hatorii*, (*Trombicula hirsti*), v.  
*hirsti*, (*T. hirsti*), v; (*T. samboni*), xii.

- Trombicula hirsti* var. *boloensis* (*T. hirsti*), v.  
var. *boloensis*, (*T. hirsti*), v.  
var. *morobensis*, (*T. hirsti*), v.  
*indica*, (*Neoschöngastia indica*), xiv.  
*insolli*, ix.  
*intermedia*, vii.  
*issiki*, vii.  
*japonica*, vii.  
*keukenschrijveri*, ix.  
*kohlsi*, xi.  
*macropus*, xii.  
*malayensis*, (*Ascoschöngastia malayensis*), xv.  
*mediocris*, v.  
*minor*, (*Trombicula minor*), v;  
(*T. hirsti*), v.  
*mundi*, ix.  
*muris*, (*Neoschöngastia indica*), xiv.  
*naultini*, xii.  
*nissani*, xi.  
*novae-hollandiae*, xii.  
*obscura*, vii.  
*oudemansi*, (*Schöngastia oudemansi*), xiii.  
*pallida*, vii.  
*palpalis*, vii.  
*palparis*, (*Trombicula palpalis*), vii.  
*piercei*, xi.  
*pluvius*, xi.  
*pseudoakamushi* Hatori, vii.  
*pseudoakamushi* Kaiwa et al., (*T. pallida*), vii.  
*pseudoakamushi* Tanaka, (*T. pallida*), vii.  
var. *deliensis* Walch, (*T. pseudoakamushi*), vii.  
*pseudo-schüffneri*, (*Schöngastia pseudoschüffneri*), xiii.  
*quadriense*, xii.  
*rara*, ix.  
*rioi*, xi.  
*robusta*, xi.  
*salmi*, (*Neoschöngastia salmi*), xiv.  
*samboni*, xii.  
*sarcina*, xii.  
*schüffneri*, (*Schöngastia schüffneri*), xiii.  
*scincoides*, xi.
- Trombicula scutellaris*, vii.  
*shuffneri*, (*Schöngastia schüffneri*), xiii.  
*signata*, xii.  
*soekaboemiensis*, (*Neoschöngastia soekaboemiensis*), xiv.  
*spicea*, ix.  
*squamosus*, x.  
*tamiyai*, vii.  
*tindalei*, xii.  
*translucens*, xii.  
*vanderghinstei*, (*T. deliensis*), viii.  
*vandersandei*, (*Schöngastia vander-*  
*sandei*), xiii.  
*walchi*, (*T. deliensis*), viii.  
*wichmanni*, vi.  
Trombiculidae, i.  
Trombiculinae, } (*Trombiculinae*), i, iii.  
Trombiculininae, } (*Trombiculinae*), i, iii.  
*Trombiculindus*, (*Trombicula*), iv.  
*squamosus*, (*Trombicula squamosus*), x.  
*Trombiculoides gateri*, (*Heaslipia gateri*), xviii.  
*Trombidium*, (*Trombicula*), iv.  
*acuscutellare*, (*T. acuscutellaris*), ix.  
*akamushi*, (*T. akamushi*), vii.  
*buloloensis*, (*T. hirsti*), v.  
*ewingi*, (*Walchia glabrum*), xxix.  
*glabrum*, (*W. glabrum*), xxix.  
*globulare*, (*Neoschöngastia globulare*), xiv.  
*wichmanni*, (*Trombicula wichmanni*), vi.  
*Typhlothrombium*, (*Gahr liepia*), xxx.  
*Walchia*, xxix.  
*buloloensis*, (*Walchia morobensis*), xxix.  
*disparunguis*, xxix.  
*enode* (-*is*), xxix.  
*glabrum*, xxix.  
*lewthwaitei*, xxix.  
*morobensis*, xxix.  
*pingue*, xxix.  
*rioi*, xxix.  
*rustica*, xxix.  
*turmalis*, xxix.  
*Walchiinae*, i, xxviii.  
*Womersleyia minuta*, xxvi.

## PART XXXV.

## Bibliography.

- AGRIC. GAZ. N.S.W., 1946.—lvii, ii, 87.  
AHLM, C. E., & LIPSHUTZ, J., 1944.—*J. Amer. Med. Ass.*, cxxiv, xvi, 1095.  
ANDERSON, W. L., & WING, W. M., 1945.—*War Medicine*, viii, iii, 163.  
ANDRÉ, M. M., 1926a.—*Bull. Mus. Nat. d'Hist. Natur.*, xxxii, i, 375.  
\_\_\_\_\_, 1926b.—*Bull. Soc. Zool. de France*, li, 175.  
\_\_\_\_\_, 1928.—*Ibid.*, lili, 368.

- ANDRÉ, M. M., 1929.—*Ibid.*, liv, 484.  
 —, 1932.—*Arch. Zool. Ital.*, xvi, iii/iv, 1355.
- AUDY, J. R., 1947.—*Nature*, No. 4035, 295.  
 —, 1950.—*Malay. Natur. J.*, v, v, ii, 38.  
 & HARRISON, J. L., 1950.—*Trans. Roy. Soc. Trop. Med. Hyg.*, xliv, iv, 371.
- BAEZL, E., & KAWAKAMI, K., 1879.—*Virch. Arch. f. path. Anat. u. Physiol.*, lxxviii, 373.
- BANERJEE, J. C., & BHATTACHARYA, P. B., 1943.—A Handbook of Tropical Diseases, 3 Ed., Calcutta.  
 & —, 1945.—*Ibid.*, 4 Ed., Calcutta.
- BANKS, N., 1915.—U.S. Dept. Agric, *Report* 108.  
 —, 1916.—*Trans. Roy. Soc. S. Aust.*, xl, 224.
- BERCOVITZ, Z. T., 1944.—Clinical Tropical Medicine, New York.
- BERLESE, A., 1888.—*Bull. Soc. Ent. Ital.*, xx, 171.  
 —, 1905.—*Redita*, ii, ii, 154.  
 —, 1910.—*Ibid.*, vi, ii, 358.  
 —, 1912.—*Ibid.*, viii, i, 1.
- BLAKE, F. G., MAXCY, K. F., SADUSK, J. F. Jr., KOHLS, G. M., & BELL, E. J., 1945a.—*Amer. J. Hyg.*, xli, iii, 243.  
 —, —, —, 1945b.—*Science*, No. 2638, 61.  
 —, —, —, 1945c.—*Amer. J. Pub. Health*, xxxv, xi, 1121.
- BLEEKER, —, 1862.—*Proc. Zool. Soc.*, 1861, 413.
- BRENNAN, J. M., 1946.—*J. Parasit.*, xxxii, 132.  
 —, 1949.—*Ibid.*, xxxv, 467.  
 & WHARTON, G. W., 1950.—*Amer. Midland Naturalist*, xliv, i, 153.
- BROWNING, 1945.—*Amer. J. Trop. Med.*, xxv, vi, 481.
- BRUMPT, E., 1910.—Précis de Parasitologie, 2 Ed., Paris, 506.  
 —, 1949.—*Ibid.*, 9 Ed., Paris, 1065.
- BULL, U.S. ARMY MED. DEPT., 1944.—lxvii, 63.
- BURNET, F. M., 1942.—*Med. J. Aust.*, Aug 22, 129.
- BUSHLAND, R. C., 1946a.—*Amer. J. Hyg.*, xlivi, 219.  
 —, 1946b.—*Ibid.*, 230.  
 —, 1946c.—*J. Econ. Entom.*, xxxix, 344.
- CHANDLER, A. C., 1936.—Animal Parasites & Human Diseases, New York, 5 Ed., 414.  
 —, 1949.—Introduction to Parasitology, New York, 8 Ed., 509.
- CILENTO, Sir R., 1944.—Tropical Diseases in Australia, Brisbane.
- COCKINGS, K. L., 1948.—*Bull. Ent. Res.*, xxxix, ii, 281.
- COOK, C. E., 1944.—*Med. J. Aust.*, ii, Ixi, 539.
- CRAIG, C. F., & FAUST, E. C., 1945.—Clinical Parasitology, London, 4 Ed.
- CULBERTSON, 1942.—Medical Parasitology, New York.
- DERRICK, E. H., SMITH, D. J. W., BROWN, H. E., & FREEMAN, M., 1939.—*Med. J. Aust.*, i, iv, 150.
- DINGER, J. E., 1933.—*Genesek. Tijdschr. v. Ned.-Ind.*, lxxiii, 283.
- DOUBOIS, A., & VAN DEN BERGHE, L., 1948.—Diseases of the Warm Climates, New York.
- DUGÈS, A., 1834.—*Ann. des Sci. Natur. (Zool.)*, i, 39.
- DUMBLETON, L. J., 1946.—*Trans. Roy. Soc. N.Z.*, lxxvi, iii, 409.
- ERRINGTON, A. F., KING, A. N., GRIFFITH, P. M., CARTER, P. R., LYNCH, M. J., Jr., MARLATT, R. B., REISMAN, H., SCHORR, H. R., VAN STEE, R. A., & RYnda, R. B., 1946.—*U.S. Nav. Med. Bull.*, xlii, 1669.
- EWING, H. E., 1920.—*Ann. Ent. Soc. Amer.*, xiii, iv, 381.  
 —, 1925.—*Amer. J. Trop. Med.*, v, iii, 251.  
 —, 1926.—*Entomol. News*, xxxvii, 111.  
 —, 1928.—*Proc. Ent. Soc. Wash.*, xxx, 77.  
 —, 1929.—A Manual of External Parasites, London.  
 —, 1931.—*Proc. U.S. Nat. Mus.*, lxxx, viii, 1.  
 —, 1933.—*Ibid.*, lxxxiii, xxix, 1.  
 —, 1937.—*Proc. Biol. Soc. Wash.*, xl, 167.  
 —, 1938.—*J. Wash. Acad. Sci.*, xxvii, 288.  
 —, 1942.—*J. Parasit.*, xxviii, 485.  
 —, 1943.—*Proc. Ent. Soc. Wash.*, xl, iii, 57.  
 —, 1944a.—*Proc. Biol. Soc. Wash.*, lvii, 101.  
 —, 1944b.—*J. Parasit.*, xxx, 339.  
 —, 1944c.—*U.S. Nav. Med. Bull.*, xlivi, iv, 837.  
 —, 1945.—*Proc. Ent. Soc. Wash.*, xlvi, iii, 63.  
 —, 1946a.—*J. Parasit.*, xxxii, v, 435.  
 —, 1946b.—*Proc. Biol. Soc. Wash.*, lix, 69.
- EWING, H. E., & HARTZELL, A., 1918.—*J. Econ. Entomol.*, xi, ii, 255.
- FABRICIUS, J. C., 1775.—*Syst. Ent.*, 430.
- FANTHAM, H. B., STEPHENS, J. W. W., & THEOBALD, F. V., 1916.—The Animal Parasites of Man, London.

- FARNER, D. S., 1946.—*Proc. Ent. Soc. Wash.*, xlviii, ii, 32.  
 ——— & KATSAMPES, C. P., 1944.—*U.S. Nav. Med. Bull.*, xlili, 800.
- FENNER, F., 1946.—*Med. J. Aust.*, Nov. 6, 666.
- FINNEGAN, SUSAN, 1945.—*Brit. Mus. (N.H.) Econ. Ser.*, xvi, London.
- FISCHBACH, W. M., & HOWELL, D. E., 1945.—*U.S. Nav. Med. Bull.*, xlvi, 423.
- FLETCHER, W., & FIELD, J. W., 1929.—*Bull. Inst. Med. Res.*, i.
- FLETCHER, W., & LESSLAR, J. E., & LEWTHWAITE, R., 1928.—*Trans. Roy. Soc. Trop. Med. Hyg.*, xxii, ii, 161.
- FONSECA, F. DA, 1932.—*Mem. Inst. Butantan*, vii, vi, 27.  
 ———, 1936.—*Ibid.*, x, 47.
- FULLER, H. S., 1947a.—*Trans. Roy. Soc. Trop. Med. Hyg.*, xl, iv, 7.  
 ———, 1947b.—*Amer. J. Hyg.*, xlvi, iii, 363.  
 ———, 1948.—*Bull. Brooklyn Ent. Soc.*, xlili, 101.  
 ———, 1949.—*Proc. Biol. Soc. Wash.*, lxii, 1.
- GATER, B. A. R., 1930.—*Trans. 8th Cong. Far East. Ass. Trop. Med.*, ii, 132.  
 ———, 1932.—*Parasitology*, xxiv, ii, 143.
- GILL, D. A., MOULE, G. R., & RIEK, E. F., 1945.—*Aust. Vet. J.*, Apr., 22.
- GISPEN, R., SMIT, A. M., & WESTERMANN, C. D., 1949.—*Doc. Neerl. Indones. de Morb. Trop.*, i, ii, 1.
- GRIFFITHS, J. T., JR., 1945.—*J. Parasit.*, xxxi, v, 341.  
 ———, 1947.—*Ibid.*, xxxiii, iv, 367.
- GUNTHER, C. E. M., 1938.—*Med. J. Aust.*, ii, vi, 202.  
 ———, 1939a.—*PROC. LINN. SOC. N.S.W.*, lxiv, i/ii, 73.  
 ———, 1939b.—*Ibid.*, v/vi, 466.  
 ———, 1939c.—*Ibid.*, v/vi, 471.  
 ———, 1940a.—*Ibid.*, lxv, iii/iv, 250.  
 ———, 1940b.—*Ibid.*, 479.  
 ———, 1940c.—*Ibid.*, v/vi, 477.  
 ———, 1940d.—*Med. J. Aust.*, Nov., 564.  
 ———, 1941a.—*PROC. LINN. SOC. N.S.W.*, lxvi, iii/iv, 155.  
 ———, 1941b.—*Ibid.*, 157.  
 ———, 1941c.—*Ibid.*, v/vi, 391.  
 ———, 1942.—*Proc. 6th Pac. Sci. Cong.*, 1939, v, 715.  
 ———, 1951.—*PROC. LINN. SOC. N.S.W.*, lxxvi, 66.
- GURBUKSH SINGH, 1945.—*Ind. Med. Gaz.*, lxxx, iv, 199.
- HALLER, G., 1882.—*Jahres. ver. f. Vaterl. Naturk. in Wurtt.*, xxxviii, 322.
- HATORI, J., 1917.—*Taiwan Igaku Zasshi*, No. 181, *fide* Hatori, 1920.  
 ———, 1919.—*Ann. Trop. Med. Parasit.*, xiii, 233.  
 ———, 1920.—*Taiwan Igaku Zasshi*, No. 209, 317 (in Kawamura, 1926).
- HAYAKAWA, K., & HOKARI, K., 1947.—A Comparative Study of Japanese & Tropical (Scrub Typhus) Tsutsugamushi Diseases, Tokyo.  
 ———, & MURO, Y., 1945.—*Nampogun Bockkyusui Bu*, cxv.
- , ICHIKAWA, R., YOSHI, S., & KOMATSU, Y., 1945.—*Ibid.*  
 ———, TANAKA, I., ICHIKAWA, K., & YOSHI, S., 1945.—*Ibid.*
- HAYASHI, N., 1910.—*Beitr. z. Hyg., Bakt., u. Infektionskr. Tokyo*, 46.  
 ———, MUROYAMA, T., & OSHIMA, F., 1918.—*Chuo Igakkai Zasshi*, xxvi, 106 (in Kawamura, 1926).
- HEASLIP, W. G., 1941.—*Med. J. Aust.*, i, xiii, 380.
- HERMS, W. B., 1939.—Medical Entomology, New York.
- HIRST, S., 1915a.—*J. Econ. Biol.*, x, iv, 79.  
 ———, 1915b.—*Bull. Entom. Res.*, vi, iii, 183.  
 ———, 1917.—*Brit. Mus. (N.H.) Econ. Ser.*, vi.  
 ———, 1921.—*Ann. Mag. Nat. Hist.*, ix, vii, 37.  
 ———, 1925a.—*Trans. Roy. Soc. Trop. Med. Hyg.*, xix, iii, 150.  
 ———, 1925b.—*Nature*, cxvi, 609.  
 ———, 1926.—*Proc. Zool. Soc. Lond.*, 825.  
 ———, 1928a.—*Ann. Mag. Nat. Hist.*, x, i, 563.  
 ———, 1928b.—*Proc. Zool. Soc. Lond.*, 1021.  
 ———, 1929a.—*Ann. Mag. Nat. Hist.*, x, iii, 564.  
 ———, 1929b.—*Proc. Zool. Soc. Lond.*, ii, 165.  
 ———, 1929c.—*Trans. Roy. Soc. S. Aust.*, iii, 24.  
 ———, 1929d.—*Trans. Roy. Soc. Trop. Med. Hyg.*, xxii, v, 451.
- H.M. STAT. OFF., 1946.—Mem. on Med. Dis. in Trop. & Subtrop. Areas, viii, 269.
- HOFFMANN, A., 1947.—*An. Esc. Nac. Cien. Biol.*, iv, 451.
- IRONS, E. N., & ARMSTRONG, H. E., 1947.—*Ann. Internat. Med.*, xxvi, ii, 201.
- JACKSON, S. W., 1908.—*Fide Sambon*, 1927.
- JACOT, A. P., 1938.—*Psyche*, xlvi, 121.
- JENKINS, D. W., 1949.—*Ann. Ent. Soc. Amer.*, xlvi, 289.
- JOHNSON, D. H., & WHARTON, G. W., 1946.—*U.S. Nav. Med. Bull.*, xlvi, 459.
- JONES, B. M., 1950.—*Parasitology*, xl, i/ii, 1.

- KAIWA, J., TERAMURA, S., & KAGAYA, J., 1929.—*Zentralbl. f. Bakter., Parasit., u. Infekt.*, cxvi, vi/vii, 23.
- KAWAMURA, R., 1926.—*Med. Bull. Coll. Med. U. Cincinnati*, iv, i/ii, 1.
- , & IKEDA, K., 1936.—*Zool. Mag. Tokyo*, xlviii, 553.
- , & YAMAGUCHI, M., 1916.—*Tokyo Iji Shinshi*, No. 1989, 1945 (in Kawamura, 1926).
- , & —, 1921.—*Kita. Arch. Exper. Med.*, iv, iii, 169.
- , & YAMAMIIYA, C., 1939.—*Ibid.*, xvi, i, 79.
- , HATORI, J., & YAMAGUCHI, M., 1920a.—*Verhandl. der jap. pathol. Gesellschaft. Tokyo*, x, 471.
- , 1920b.—*Nippon Byorigaku Zasshi*, x, 470 (in Kawamura, 1926).
- , 1921.—*Tokyo Iji Shinshi*, No. 2213, 250 (in Kawamura, 1926).
- KISHIDA, K., 1909 (?).—*Fide Kishida*, 1917.
- , 1917.—*Iji Shimbun*, No. 974, 671 (in Kawamura, 1926).
- KITASHIMA, T., & MIYAJIMA, M., 1918a.—*Kita. Arch. Exper. Med.*, ii, 91.
- , 1918b.—*Saikingaku Zasshi*, clxxvii (in Kawamura, 1926).
- KLEIN, H. S., 1945.—*J. Roy. Army Med. Corps*, lxxxv, iv, 167.
- KOHL, G. M., 1948.—*Amer. Ass. Adv. Sci. Wash.*, 83.
- KOHL, G. M., ARMBRUST, C. A., IRONS, E. N., & PHILIP, C. B., 1945.—*Amer. J. Hyg.*, xli, iii, 374.
- KOUWENAAAR, W., & WOLFF, J. W., 1942.—*Proc. 6th Pac. Sci. Cong.*, 1939, v, 633.
- , 1944.—Conf. H.Q. Cey. Army Comm.
- KRISHNAN, K. V., 1950.—*Trans. Roy. Soc. Trop. Med. Hyg.*, xliv, iv, 397.
- KUWATA, T., BERGE, T. O., & PHILIP, C. B., 1950.—*J. Parasit.*, xxxvi, i, 1.
- LATREILLE, P. A., 1804.—*Histoire Naturelle des Crustacées et des Insectes*, Paris, 8 Ed., 55.
- LAWRENCE, R. F., 1949.—*Ann. Natal Mus.*, xi, iii, 32.
- LEGG, J., 1944.—*Rep. Dept. Agric. Q'land*, 1944-45, Brisbane, 17.
- LEONARDI, G., 1901.—*Zool. Anzeiger*, xxv, 18.
- LEWTHWAITE, R., 1930.—*Bull. Inst. Med. Res. F.M.S.*, i.
- , 1945a.—*Brit. Med. Bull.*, iii, ix, 227.
- , 1945b.—*Lancet*, June 16 (Correspondence).
- , & SAVOOR, S. R., 1936a.—*Brit. J. Exper. Path.*, xvii, 461.
- , 1936b.—*Ibid.*, 309.
- , 1936c.—*Ibid.*, 208.
- , 1936d.—*Trans. Roy. Soc. Trop. Med. Hyg.*, xxix, vi, 561.
- , 1940.—*Lancet*, 255.
- LOGUE, J. B., 1944.—*U.S. Nav. Med. Bull.*, xlili, 645.
- MACKIE, T. T., HUNTER, G. W., & WORTH, C. B., 1945.—*Manual of Tropical Medicine*, Philadelphia.
- MACKIE, T. T., DAVIS, G. E., FULLER, H. S., KNAPP, J. A., STEINAKER, M. L., STAGER, K. E., TRAUB, R., JELLISON, W. L., MILLSPAUGH, D. D., AUSTRIAN, R. C., BELL, E. J., KOHL, G. M., WEI-HSI, & GIRSHAM, J. A. V., 1946.—*Amer. J. Hyg.*, xlili, iii, 195.
- MANSON-BAHR, Sir P., 1929.—*Manson's Tropical Diseases*, 9 Ed., London.
- , 1940.—*Ibid.*, 11 Ed., London.
- , 1948.—*Ibid.*, 12 Ed., London, 237.
- MATHESON, 1932.—*Medical Entomology*, Springfield.
- MCCULLOCH, R. N., 1944.—*Med. J. Aust.*, ii, 543.
- , 1946.—*Ibid.*, May 25, 717.
- , 1947.—*Ibid.*, i, xv, 449.
- MEGAW, Sir J. W. D., 1945.—*Brit. Med. J.*, ii, 109.
- MEHTA, D. R., 1937.—*Ind. J. Med. Res.*, xxv, ii, 353.
- MICHENER, C. D., 1946a.—*Ann. Ent. Soc. Amer.*, xxxix, i, 101.
- , 1946b.—*Ibid.*, iii, 349.
- , 1946c.—*Ibid.*, 411.
- , 1946d.—*Ibid.*, 431.
- , & FULLER, H. S., 1946.—*Ann. Ent. Soc. Amer.*, xlvi, ii, 204.
- MIYAJIMA, M., 1917.—*Dobutsugaku Zasshi*, xx, No. 237 & 239 (in Kawamura, 1926).
- , & OKUMURA, T., 1915.—*Saikingaku Zasshi*, No. 243 (in Kawamura, 1926).
- , 1916a.—*Ikai Jijo*, No. 1160, 1540 (in Kawamura, 1926).
- , 1916b.—*Saikingaku Zasshi*, No. 253, 1091 (in Kawamura, 1926).
- , 1917a.—*Ibid.*, No. 266, 893 (in Kawamura, 1926).
- , 1917b.—*Kita. Arch. Exper. Med.*, i, i, 1.
- MOHR, C. O., 1947.—*Ecology*, xxviii, 194.
- MORISHITA, K., 1942.—*Proc. 6th Pac. Sci. Cong.*, 1939, v, 639.
- MÜHLENS, K., NAUCH, E. G., VOEGEL, & RUGE, 1938.—*Krankh. u. Hyg. der warm. Lander*, Leipzig.
- NAGAYO, M., MIYAGAWA, Y., MITAMURA, T., & IMAMURA, A., 1915a.—*Tokyo Igaku Zasshi*, xxix (in Kawamura, 1926).
- , —, —, 1915b.—*Dobutsugaku Zasshi*, xxvii, 336 (in Kawamura, 1926).
- , —, —, 1915c.—*Iji Shimbun*, No. 941 & 956 (in Kawamura, 1926).
- , —, —, 1915d.—*Nippon Byorigaku Zasshi*, vi (in Kawamura, 1926).
- , —, —, 1915e.—*Dobutsugaku Zasshi*, xxviii, 300 (in Kawamura, 1926).

- NAGAYO, M., MIYAGAWA, Y., MITAMURA, T., & IMAMURA, A., 1915f.—*Ibid.*, 379 (in Kawamura, 1926).
- — — —, 1916a.—*Fide Wharton et al.*, 1951: *Iji Shim bun*, No. 956, 1081.
- — — —, 1916b.—*Iji Shim bun*, No. 958, 1 (in Kawamura, 1926).
- — — —, 1917a.—*J. Exper. Med.*, xxv, ii, 255.
- — — —, 1917b.—*Ibid.*, 273.
- — — —, & TAMIYA, T., 1918.—*Nippon Byorigaku Zasshi*, viii (in Kawamura, 1926).
- NAGAYO, M., MIYAGAWA, Y., MITAMURA T., & TAMIYA, T., 1919.—*Verhandl. der jap. pathol. Gessellsch. Tokyo*, ix, 107.
- NAGAYO, M., MITAMURA, T., & TAMIYA, T., 1920a.—*Jikken Igaku Zasshi*, iii, iv, 265 (in Kawamura, 1926).
- — — —, 1920b.—*Verhandl. der jap. pathol. Gessellsch. Tokyo*, ix, 143.
- — — —, 1920c.—*Nippon Byorigaku Zasshi*, x, 503 (in Kawamura, 1926).
- NAGAYO, M., MIYAGAWA, Y., MITAMURA T., TAMIYA, T., & TENJIN, S., 1921.—*Amer. J. Hyg.*, i, 1, 569.
- NAUSS, R. W., 1944.—Medical Parasitology & Zoology, New York.
- No. 2 ENTOMOL. FD. UNIT, S.E.A.C., 1945.—C.O.'s 10th Report.
- OGATA, M., 1906.—*Deutsch. Med. Wehnschr.*, xxxii, 1828.
- — — —, & ISHIWARA, K., 1907-1917.—*Ibid.*, viii-xiii.
- OKUMURA, T., 1918.—*Saikingaku Zasshi*, No. 277, 706 (in Kawamura, 1926).
- ONUMA, 1917.—*Iji Shim bun*, No. 987 (in Kawamura, 1926).
- OUDEMANS, A. C., 1905.—*Ent. Ber. Ned. Ent. Ver.*, i, xxii, 216.
- — — —, 1906.—*Nova Guinea*, v (Zool.), i, 101.
- — — —, 1909.—*Ent. Ber. Ned. Ent. Ver.*, iii, xliv, 14.
- — — —, 1910a.—*Ibid.*, iii, lv, 86.
- — — —, 1910b.—*Ibid.*, iii, lvi, 104.
- — — —, 1910c.—*Bull. Ent. Res.*, i, ii.
- — — —, 1911.—*Ent. Ber. Ned. Ent. Ver.*, iii, lviii, 137.
- — — —, 1912a.—*Ibid.*, iii, lxvii, 272.
- — — —, 1912b.—*Zool. Jahrb.*, xiv, i, 1.
- — — —, 1913.—*Ibid.*, xiv, i.
- — — —, 1914.—*Ent. Ber. Ned. Ent. Ver.*, iv, 84.
- — — —, 1916.—*Zool. Jahrb.*, xiv, i.
- — — —, 1922.—*Ent. Ber. Ned. Ent. Ver.*, vi, cxxvi, 81.
- — — —, 1928.—“Acar” in Fauna Buruana, Treubia, vii, Suppl. ii, 89.
- — — —, 1929.—*Ent. Ber. Ned. Ent. Ver.*, vii, cxv, 398.
- PATTON, W. S., 1931.—Insects, Ticks, Mites, & Venomous Animals, ii, Croydon.
- — — —, & EVANS, A. M., 1929.—*Ibid.*, i, Croydon.
- PHILIP, C. B., 1947a.—*Amer. J. Hyg.*, xlvi, i, 45.
- — — —, 1947b.—*Ibid.*, 60.
- — — —, 1947c.—*J. Parasit.*, xxxiii, v, 387.
- — — —, 1948.—*Ibid.*, xxxiv, iii, 169.
- — — —, 1949.—*Sci. Monthly*, lix, v, 281.
- — — —, & FULLER, H. S., 1950.—*Parasitology*, xl, 50.
- — — —, & KOHLS, G. M., 1945.—*Amer. J. Hyg.*, xlvi, ii, 195.
- — — —, 1948.—*Proc. 4th Int. Cong. Trop. Med. & Mal.*, 1656.
- — — —, & TAMIYA, T., 1946.—*Nippon Eiseigaku Zasshi*, i, i, 15.
- — — —, & TRAUB, R., 1950.—*J. Parasit.*, xxxvi, i, 29.
- — — —, & WOODWARD, T. E., 1946a.—*Amer. J. Trop. Med.*, xxvi, ii, 157.
- — — —, 1946b.—*J. Parasit.*, xxxii, v, 502.
- — — —, & SULLIVAN, R. H., 1946.—*Amer. J. Trop. Med.*, xxvi, ii, 229.
- — — —, TRAUB, R., & SMADEL, J. E., 1949.—*Amer. J. Hyg.*, i, i, 63.
- POYNTON, J. O., 1941.—*Med. J. Aust.*, Mar. 29, 373.
- PULLEN, R. L., 1950.—Communicable Diseases, Philadelphia, 753.
- RADFORD, C. D., 1942.—*Parasitology*, xxxiv, 55.
- — — —, 1946a.—*Ibid.*, xxxvii, 42.
- — — —, 1946b.—*Ibid.*, 46.
- — — —, 1946c.—*Proc. Zool. Soc.*, cxvi, ii, 247.
- — — —, 1948.—*Ibid.*, cxviii, i, 126.
- RICHARDS, W. S., 1950.—*Parasitology*, xl, i/ii, 105.
- RILEY, W., & JOHANNSEN, O. A., 1938.—Medical Entomology, New York.
- ROGERS, Sir L., & MEGAW, Sir J. W. D., 1944.—Tropical Medicine, 4 Ed., London.
- — — —, 1946.—*Ibid.*, 5 Ed., London.
- ROY, D. N., 1946.—Entomology, Calcutta.
- SADUSK, J. F., Jr., 1947.—The Infectious Diseases, 100.
- SALM, G., 1923.—*Bull. Soc. Path. Exot.*, xvi, 336.
- SAMBON, L. W., 1927.—*Ann. Mag. Nat. Hist.*, ix, xx, 157.
- — — —, 1928.—*Ann. Trop. Med. Parasit.*, xxii, 67.
- SAYERS, M. H. P., et al., 1947.—Report of Scrub Typhus Res. Lab., War Office.
- SHAW, G., 1790.—Naturalist's Miscellany, 2 Ed., plate 42.
- — — —, 1806.—General Zoology, 6 Ed., ii, 464.

- SMART, J., 1948.—Insects of Medical Importance, 2 Ed., London.
- SOUTHCOTT, R. V., 1947.—*Med. J. Aust.*, ii, xv, 441.
- STITT, E. R., 1929.—The Diagnostics & Treatment of Tropical Diseases, 5 Ed., York.
- STRONG, R. P., 1944.—Diagnosis, Prevention, & Treatment of Tropical Diseases, Philadelphia.
- SUGIMOTO, M., 1936a.—*J. Jap. Soc. Vet. Sci.*, xv, i, 201.
- , 1936b.—*J. Soc. Trop. Agric. Formosa*, viii, 241.
- , 1938.—*J. Jap. Soc. Vet. Sci.*, xvii, i, 58.
- TAKEKAWA, S., 1914.—*Nampogun Boekikyusui Bu*, ciii.
- , 1945.—*Ibid.*, cxxvi.
- , ICHIKAWA, R., & HAYAKAWA, K., 1944.—*Ibid.*, ciii.
- TANAKA, K., 1899.—*Zentralbl. f. Bakter., Parasit., u. Infekt.*, xxvi, 432.
- , 1906a.—*Ibid.*, xlii, xvi, 104.
- , 1906b.—*Tokyo Igaku Zasshi*, xxx, xxxii (in Kawamura, 1926).
- , 1916.—*Ikai Jijo*, No. 1164, 1700 (in Kawamura, 1926).
- , 1918.—*Ibid.*, No. 1228, 19 (in Kawamura, 1926).
- , 1919.—*Ibid.*, No. 1238 (in Kawamura, 1926).
- TANAKA, K., KAIWA, J., TERAMURA, S., & KAGAYA, J., 1930.—*Zentralbl. f. Bakter., Parasit., u. Infekt.*, cxvi, 353.
- THOR, S., 1935.—*Zool. Anzeiger*, cix, 107.
- , 1936.—*Ibid.*, cxiv, i/ii, 29.
- , & WILLMANN, C., 1947.—Das Tierreich, 71b, Trombidiidae, 187.
- TIDY, Sir H. L., 1945.—A Synopsis of Medicine, 8 Ed., London, 309.
- TORRES, S., & BRAGA, W., 1939.—*Bol. Soc. Bras. Med. Vet. An.*, ix, 1.
- TRAUB, R., 1949.—*Amer. J. Hyg.*, l, iii, 361.
- , & EVANS, T. M., 1950a.—*J. Wash. Acad. Sci.*, xl, iv, 126.
- , —, 1950b.—*J. Parasit.*, xxxvi, iv, 356.
- , & FRICK, L. P., 1950.—*Amer. J. Hyg.*, li, ii, 242.
- , & SUNDERMEYER, E. W., 1950.—*Proc. Helminth. Soc. Wash.*, xvii, i, 35.
- , FRICK, L. P., & DIERCKS, F. H., 1950.—*Amer. J. Hyg.*, xl, iii, 269.
- TSURUKI, 1915.—On Tsutsugamushi Disease in Yamagata Prefecture, Tokyo.
- U.S. WAR DEPT., 1944.—*Tech. Bull. Med.*, xxxi, i.
- , 1948.—*Ibid.*
- VERDUN, P., 1909.—*C.R. Soc. Biol. Paris*, lxvii, 245.
- VITZTHUM, GRAF H. VON, 1929.—"Acaris" in Die Tierwelt Mitteleuropa, iii, vii, 1.
- von GOOSMANN, F., 1917.—*Zool. Anzeiger*, xlviii, 337.
- WALCH, E. W., 1922a.—*Geneesk. Tijdschr. v. Ned.-Ind.*, lxii, 5.
- , 1922b.—*Ibid.*, 530.
- , 1923.—*Kita. Arch. Exper. Med.*, v, iii, 63.
- , 1924a.—*Trans. 5th Bienn. Cong. Far East. Ass. Trop. Med.*, 583.
- , 1924b.—*Geneesk. Tijdschr. v. Ned.-Ind.*, lxiv, 1.
- , 1925.—*Kita. Arch. Exper. Med.*, vi, iii, 235.
- , 1927.—*Geneesk. Tijdschr. v. Ned.-Ind.*, lxvii, 922.
- , & KEUKENSCHRIJVER, N. C., 1923.—*Ibid.*, lxiv, 2.
- , —, 1924.—*Trans. 5th Bienn. Cong. Far East. Ass. Trop. Med.*, 627.
- , —, 1925.—*Arch. f. Schiffs-u. Tropenhyg.*, xxix, 420.
- WARBURTON, C., 1928.—*Parasitology*, xx, xx, 228.
- WHARTON, G. W., 1945a.—*J. Parasit.*, xxxi, iv, 282.
- , 1945b.—*Ibid.*, vi, 401.
- , 1946a.—*Proc. Ent. Soc. Wash.*, xlvi, vii, 171.
- , 1946b.—*Ecol. Monogr.*, xvi, iii, 151.
- , 1946d.—*J. Parasit.*, xxxii, iv, 299.
- , 1947a.—*Ibid.*, xxxiii, iii, 200.
- , 1947b.—*Ibid.*, 260.
- , 1947c.—*Ibid.*, iv, 380.
- , & CARVER, R. K., 1946.—*Science*, civ, No. 2691, 76.
- , & HARDCastle, A. B., 1946.—*J. Parasit.*, xxxii, iii, 286.
- , JENKINS, D. W., BRENNAN, J. M., FULLER, H. S., KOHLS, G. M., & PHILIP, C. B., 1951.—*J. Parasit.*, xxxvii, i, 13.
- WILLIAMS, R. W., 1944.—*Amer. J. Trop. Med.*, xxiv, 355.
- WILLMANN, C., 1941.—*Zool. Anzeiger*, cxxxiii, v/vi, 131.
- WOMERSLEY, H., 1934.—*Rec. S. Aust. Mus.*, v, ii, 179.
- , 1936.—*Linn. Soc. J. (Zool.)*, xl, 107.
- , 1937.—*Rec. S. Aust. Mus.*, vi, i, 75.
- , 1939.—*Trans. Roy. Soc. S. Aust.*, ixiii, ii, 149.
- , 1944.—*Ibid.*, lxviii, i, 82.
- , 1945.—*Ibid.*, lxix, i, 96.
- , & HEASLIP, W. G., 1943.—*Ibid.*, lxvii, i, 68.
- , & KOHLS, G. M., 1947.—*Ibid.*, lxxi, i, 3.
- WOODWARD, T. E., PHILIP, C. B., & LORANGER, G. L., 1946.—*J. Infect. Dis.*, ixxxviii, 167.

I wish to take this opportunity to thank my many friends all over the world for their kindness in sending me reprints and references. The above list is not complete, and many errors will inevitably have crept into it. May I invite readers who locate omissions or errors to let me know of them, so that at a later date I may be able to publish a supplement containing additions and corrections?

## INDEX OF PARTS.

Part.	p.	Part.	p.	Part.	p.	Part.	p.	Part.	p.
i .....	1	viii .....	15	xv .....	36	xxii .....	38	xxix .....	43
ii .....	2	ix .....	17	xvi .....	36	xxiii .....	39	xxx .....	46
iii .....	3	x .....	19	xvii .....	36	xxiv .....	39	xxxi .....	46
iv .....	3	xi .....	19	xviii .....	36	xxv .....	42	xxxii .....	47
v .....	5	xii .....	21	xix .....	37	xxvi .....	42	xxxiii .....	48
vi .....	8	xiii .....	22	xx .....	37	xxvii .....	42	xxxiv .....	50
vii .....	9	xiv .....	26	xxi .....	37	xxviii .....	43	xxxv .....	54

## 'ECOLOGICAL CLASSIFICATION AND NOMENCLATURE.

By N. C. W. BEADLE, Department of Botany, University of Sydney,  
and A. B. COSTIN, Faculty of Agriculture, University of Sydney.

With a Note on Pasture Classification, by C. W. E. MOORE, Division of  
Plant Industry, C.S.I.R.O.

[Read 26th March, 1952.]

---

### *Introduction.*

The classification of vegetation in Australia is seriously hindered by a lack of general agreement on many basic principles concerning both classificatory units and terminology. This disagreement concerns not only the floristically determined units such as the association and alliance, but also the structural units, the formations and sub-formations. Perhaps the greatest confusion over classification has arisen because of the erroneous impression that climate is the controlling factor in determining vegetation. With this in mind many ecologists have named structural units in terms of the climate, or have introduced a term indicative of an ecosystem rather than of a plant community. Furthermore, different usages of the all-important but ill-defined term "association" have led to considerable confusion with regard to floristic units. Davis (1936, 1941a, 1941b), for example, uses this term in a much more restricted sense than do Pryor (1939), Pidgeon (1942) and Beadle (1948). One is tempted to suggest that the size of the association as used by different Australian ecologists has been governed in part by the extent of the area under investigation. An even more serious aspect of disagreement at present existing between ecologists in the southern and eastern Australian States is the concept of species dominance in relation to the classification of plant communities. South Australian ecologists (e.g., Crocker and Wood, 1947) are prepared to recognize as dominant species members of either the tallest stratum or of subordinate strata, or of both, while ecologists in New South Wales restrict the term to the tallest species, except in communities where the tallest stratum is very open.

In addition to the above difficulties which have arisen because of disagreement among ecologists themselves, there are the inherent difficulties which arise when an attempt is made to classify any natural system. Vegetation, soils, and animal communities usually vary continuously and in several directions; accordingly, any attempt to classify a continuously varying system into several categories must necessarily be somewhat arbitrary, in so far as at some points the system must be broken into distinct groups. The selection of these critical points for subdivision inevitably constitutes a controversial issue, since classification is essentially a compromise between the desire to preserve these natural groupings as continuously varying entities and the need to subdivide them for more utilitarian purposes.

Since Australian ecologists are at present embarking upon an intensive mapping programme, the writers feel that there is an immediate need for laying down a general classificatory scheme which will lead to some uniformity in ecological units within Australia. This scheme, which is a modification of the European and American systems, supplemented by certain miscellaneous terms, is outlined below; it replaces the monoclimax concept of Clements which dominated Australian ecologists in the past. Based on the principle that vegetation should be described objectively in terms of its floristics and structure without reference to the complex of factors governing it

(the interpretation of the status of the community is not part of this descriptive account), this scheme has resulted from experience in environments ranging from alpine to semi-arid and subtropical.

#### PRINCIPLES RELATING TO VEGETATION CLASSIFICATION.

##### 1. *Floristics and Structure.*

Before attempting to classify plant communities, an understanding of the most important floristic and structural properties is essential. A knowledge solely of the species present in the community is insufficient; their qualitative and quantitative interrelationships and their interrelationships in space and time must also be considered.

The qualitative and quantitative data may be determined approximately by visual, semi-subjective methods which in themselves provide sufficient basic information at least to recognize the most abundant species, or by detailed statistical methods such as those employed by Scandinavian ecologists. The large areas of vegetation in Australia generally restrict observations to the former semi-subjective method. This method permits the recognition of the most abundant species, and if necessary can easily be extended to other species, leading to their classification as abundant, frequent, common, occasional, rare, or very rare, depending on their relative abundance in the community.

Except in simple single-layered communities the above-mentioned qualitative and quantitative data are inadequate for the precise description of the community. A more precise description is provided by a knowledge of the spatial relationships (structure) of the plants comprising the community. A still more complete picture of the community will result if the structural data are supplemented by data on the life-forms of the individual species according to the system proposed by Raunkiaer (1934). If the life-forms of all the species in the community are known, they may be expressed in quantitative, comparative terms on a percentage basis known as the life-form spectrum (= biological spectrum). However, it should be emphasized that the life-form system does not always reflect the climate alone of the community, as claimed by Raunkiaer. A more detailed scheme for describing and recording vegetation on a structural basis has been proposed recently by Dansereau (1951).

While the number of floristic groupings is virtually unlimited, the number of structural expressions of vegetation is relatively few. These can be classified into a definite number of structural forms and sub-forms which are listed in Table 1. Additional groups may be added if necessary. With regard to these structural forms, the following notes are relevant:

(i) Transitions from one form (or sub-form) to another frequently occur; for example, grassland commonly grades into savannah, and savannah into savannah woodland; tall woodland grades into dry sclerophyll forest, etc. To avoid the introduction of additional specific terms it is proposed that these transitions be accommodated by prefixing the designation by "tall", "low", "sparse", "dense", as the case may be. Similarly for the term "deciduous", when this is applicable.

(ii) The terms "wet" and "dry" in structural designations, such as wet and dry scrub, wet and dry sclerophyll forest, refer to the plant community itself and not necessarily to the habitat. "Wet", in contrast to "dry", is used to signify a higher degree of mesomorphism, or a higher incidence of helophytes.

##### 2. *Animal Communities.*

The faunal associates of vegetation have generally been neglected by plant ecologists. However, they are closely integrated with the plants in a single biotic community and should therefore be described wherever possible. Since the role of animals in most terrestrial vegetation is that of coaction rather than dominance, animal communities should be described in terms of the stratum or strata which constitute their most important habitat and feeding niches (e.g., subterranean, floor, herbaceous, shrub, tree strata, etc.), together with relevant notes as to their role as predators, omnivores, or herbivores and with further qualification if required as to

their outstanding habits and mode of locomotion (e.g., nocturnal, saltatorial, cursorial, fossorial, arboreal, etc.). For more detailed treatment the works of Allee *et al.* (1949), and Clements and Shelford (1939) should be consulted.

### 3. *Maturity Status.*

It is customary to use different terminology for the naming of climax (mature) and seral (immature) communities. However, since ecologists vary so much in their concept of the climax (and stable equilibrium), no strict ruling for the assessment of maturity status is proposed at this stage. To the writers the decision is inconsequential as far as the objective classification is concerned, since any community must be described in terms of its floristics and structure. The appending of a unit name indicative of the status in no way alters this description; in fact the only possible disagreement that can arise from a difference in the interpretation of status is the use as a unit name of "association" for "associes" or vice versa.

One principle only need be mentioned: The writers reject the Clementian monoclimax theory, which recognizes only one climax, the climatic climax, in a region, and regard all other types of vegetation as seral stages of the climatic climax. So also the term post-climax in the Clementian sense, used extensively by Davis, Pidgeon, and Beadle, must be rejected on the ground that the term connotes time, postulating a condition that would exist if the climate were to improve.

In the place of the Clementian interpretation of climax, any one of the following procedures may be adopted:

(i) All communities may be regarded as climax and described according to the terms, associations, alliances, etc., as outlined in the following pages.

(ii) The climax may be regarded as distinct from seral communities in so far as it is independent of the time factor. For practical purposes the climax may be regarded as a relatively permanent community which continues to regenerate and maintain itself for considerable periods of time which are long in comparison with the life span of the longest-lived individuals of the community. Communities which do not exist for much longer periods than the longest-lived individuals in them may be considered seral (Pryor, 1951). This time criterion is subjective, but field evidence such as that on the age of seedlings, saplings and mature trees, on the type of dispersion, and on the condition of the associated soils, lends support to this principle.

(iii) If a refinement of (ii) is required, the climax may be qualified in terms of the factor which limits it in a particular area. Thus we may recognize climatic, physiographic, edaphic, anthropogenic, and in special cases biological climaxes as communities which are limited respectively by climate, physiography, soil parent material, man, and the flora or fauna. By analogy a stage in a sere may be regarded as a temporal climax, in so far as it is limited by time; if a temporal climax represents the penultimate stage of a succession and is similar in structure to the ultimate stage (the climax), it may be designated as a subclimax in the Clementian sense.

In assessing the climax status of vegetation it should be borne in mind that the same community developed in different areas will not necessarily occur as the same type of climax: a particular savannah woodland community, for example, may occur as a climatic climax in sub-humid areas on a wide range of soil parent materials and slopes, whereas in humid environments its status is frequently that of an edaphic climax in so far as it is restricted to soils of heavy texture such as those derived from basalt. Similarly, the same community may occur as a climax in stable equilibrium with the environment in one area, and as a stage in a succession in another.

The assessment of maturity status is essentially a study of communities in relation to the limiting factors of their environments; it does not affect the description of the communities nor, to any appreciable extent, their ecological classification. Accordingly, disagreement among ecologists regarding the determination of maturity status, which is somewhat subjective particularly with regard to the time factor, should not influence their acceptance of a uniform scheme of ecological description and classification on the basis of the floristics and structure of the plant communities themselves.

TABLE I.

The structural forms and sub-forms, with synonyms (for authorities, see Glossary).

<i>Form.</i>	<i>Sub-form.</i>	<i>Synonyms.</i>
GRASSLAND	Hummock grassland	Sclerophyllous-, desert-, spinifex-, porcupine grassland
	Dry tussock grassland	Grassland, savannah, grass steppe, downs
	Wet tussock grassland	Meadow grassland
	Sod tussock grassland	Mountain-, alpine-, sub-alpine grassland
SAVANNAH	Shrub savannah	Savannah scrub
	Tree savannah	
	Mallee savannah	
ALPINE HERBFIELD	Tall alpine herbfield	Alpine meadow, herbfield, herb moor, mountain meadow
	Short alpine herbfield	
FEN		Low moor, Niedermoor, Flachmoor, marsh, swamp
BOG	Valley bog	Mixed mire, extreme acid fen, transition moor
	Raised bog	Raised moss, Hochmoor
FELDMARK		Fell-field, wind desert, fjaeldmark, Felsen-fluren, Fjälld-markar
HEATH		Heather
SALTBUCK		Shrub-steppe
SCRUB	Dry scrub	
	Wet scrub	
	Mangrove scrub	Tidal-, littoral scrub
MALLEE	Dry mallee	
	Wet mallee	
WOODLAND	Shrub woodland	
	Savannah woodland	
	Tall woodland	
	Sub-alpine woodland	Alpine woodland
	Swamp woodland	
SCLEROPHYLL FOREST	Dry sclerophyll forest	
	Wet sclerophyll forest	
	Swamp sclerophyll forest	
RAINFOREST	Temperate rainforest	Subantarctic rainforest, beech forest
	Subtropical rainforest	
	Tropical rainforest	
	Monsoon rainforest	Monsoon forest, deciduous rainforest

## THE CLASSIFICATION OF CLIMAX VEGETATION.

## A. THE FLORISTIC UNITS.

1. *The Association.*

The basic floristic unit for the classification of climax plant communities is the ASSOCIATION.

An Association is defined as a climax community of which the dominant stratum has a qualitatively uniform floristic composition and which exhibits a uniform structure as a whole.

*Note:*

(i) The dominant stratum is the stratum which, because of its physiognomy and relative continuity, dominates the rest of the community in the sense that it conditions the habitats of the other strata (Moore, 1951) (cf. "Dominant", as defined in Glossary).

(ii) Pryor (1951) justifiably points out that, in defining floristics, it is sometimes necessary to work at the level of the ecotype rather than at the level of the species, particularly with species of *Eucalyptus*.